

1. 研究活動 / **Research Overview**

1. 研究活動 (2012年4月～2013年3月)

1.1 研究活動概要

(1) 乾燥地研究センターについて

乾燥地研究センターは国立大学法人鳥取大学の独立部局であると同時に、共同利用・共同研究拠点である。その設置目的は、「乾燥地における砂漠化や干ばつなどの諸問題に対処し、乾燥地における自然—社会系の持続性の維持・向上に資する研究を中核的研究教育拠点として推進し、乾燥地科学分野の研究者の利用に供すること」にある。

文部科学省の研究拠点形成費等補助金事業による21世紀COEプログラム(平成14～18年度)やグローバルCOEプログラム「乾燥地科学拠点の世界展開」(平成19～23年度)により、乾燥地科学分野の研究水準の向上と世界をリードする創造的な人材を育成し、研究・教育の世界的ネットワークも形成した。

本拠点形成の目的は、研究面においては、乾燥地研究センターがその前身を含めてこれまでに蓄積した砂地における植物生産や植生回復に関する知見と技術を、広く世界の乾燥地土壌に適用可能なものへと高度化するとともに、これに社会経済分野や医学分野などの知見や技術を融合させて、世界の砂漠化対処に資する、健康的な人間生活の営みを保障する「新たな乾燥地科学」を構築することにある。一方、教育面においては、大学院生(修士課程、博士課程)、研究生、JICA等からの外国人委託研究員等の教育を担当し、乾燥地の砂漠化対処に関わる国際機関や企業、NGOなどが必要とする研究者や技術者を養成することである。

本拠点の形成は、世界の乾燥地科学の発展、国連砂漠化対処条約に係る我が国の貢献義務の履行及び当該分野の人材育成にとって重要な意義を有する。

平成22年2月には、日本学術振興会による組織的な若手研究者等海外派遣プログラム(平成22年2月～平成25年1月)を開始。本プログラムでは、若手研究者の海外協力機関への派遣を通して、若手研究者の人材育成を行った。

平成23年には、黄砂プロジェクト「東アジア砂漠化地域における黄砂発生源対策と人間・環境への影響評価」(平成23年度～平成27年度)が文部科学省特別経費事業に採択され、東アジアにおける黄砂の発生メカニズムの解明、黄砂の影響評価および発生源対策技術の開発に取り組んでいる。

また、黒崎泰典プロジェクト研究員(現センター助教)が、モンゴルから中国東北地方の草原・耕作域において、地表面状態の変化(臨界風速の減少)が顕著な黄砂多発を引き起こしていたことを明かにした論文が、平成23年にAmerican Geophysical Union(AGU)の学会誌Geophysical Research Lettersに掲載され、この論文はAGU Research Spotlightに選ばれた。

平成24年4月には、乾燥地に由来する植物を用いた研究の進展のため、共同利用・共同研究拠点の機能を拡

1. Research Overview (April 2012–March 2013)

1.1 Outlines of Research Activities

(1) About Arid Land Research Center

The Arid Land Research Center (ALRC) is an independent department of Tottori University and, at the same time, is a Joint Usage/ Research Center. The mission of the ALRC is to conduct research on desertification and to develop sustainable agricultural practices in arid and semi-arid areas. The door is open to all researchers who are engaged in the field of Dryland Science.

Tottori University had undertaken the 21st COE Program “Program for Arid Land Science” for five years from FY 2002 to FY 2006, and Global COE program “Global Center of Excellence for Dryland Science” for five years from FY 2007 to FY 2011, both of which were funded by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). These MEXT-sponsored programs had helped establish a global network in terms of education and research, while contributing to the enhancement of the level of research in the field of the dryland science and nurturing internationally-active, competent researchers.

The goals of the establishment of the Center are, with regard to research, to advance knowledge and technologies concerning plant production and revegetation of deserts, which the Arid Land Research Center and its predecessor have accumulated, so it can be widely applied to arid land soils around the world. Simultaneously, blending this with knowledge and technologies in the social economics and medical fields etc., in order to build a new Science of Arid Land that contribute to combat global desertification and ensure people’s healthy daily lives. In the educational field, Arid Land Research Center’s mission is to nurture researchers and advance technologists to deal with arid lands that are required by international organizations, corporations, NGOs etc. through educating graduate students (Masters and Doctor courses), research students, and international researchers from Japan International Cooperation Agency (JICA), etc.

The establishment of the Center is extremely significant in terms of fulfilling Japan’s obligation to contribute to the development of the world’s Science of Arid Land and to the United Nations Convention to Combat Desertification and the training of personnel in this field.

Tottori University, led by the Arid Land Research Center, had conducted the “Institutional Program for Young Researcher Overseas Visits” funded by the Japan Society for the Promotion of Science (JSPS) from February 2010 to January 2013. This three-year program offered young researchers opportunities to learn and gain experience at overseas research institutions.

We have started the Asian Dust Project “Assessment and Control of Dust Emission in Degraded Drylands of East Asia” sponsored by MEXT in FY 2011. The goal of this five year project is to assess the dust effects on human health and environments, to elucidate the dust emission and sandstorm mechanisms, and develop mitigation techniques.

Under this project, Dr. Kurosaki, Y. (Project Researcher, currently Assistant Professor) clarified that changes in soil and land surface caused a dramatic increase in the occurrence of dust storms over grassland and cultivated land from Mongolia to northeastern China by an analysis of threshold

充して、乾燥地植物資源バンク室を開設した。

平成 24 年 12 月には、鳥取大学が文部科学省の平成 24 年度研究拠点形成等補助金「卓越した大学院拠点形成支援補助金」に採択された。

平成 25 年 3 月 19 日～21 日に中国（北京）で開催された第 11 回乾燥地開発国際会議（ICDD）には、多くのセンター関係者が参加し、研究発表等を行った。

また、乾燥地研究センターは、文部科学省の平成 24 年度科学技術人材育成補助金「テニュアトラック普及・定着事業」に申請し、採択された。これを受け、平成 25 年 3 月、テニュアトラック教員（助教）1 名を採用した。

組織・運営体制

本センターは、センター長、副センター長、教授会（教授、准教授等で構成）、運営委員会（外部委員、学内委員、センター専任教授で構成）及び共同研究委員会（外部委員、センター専任教授で構成）、5 研究部門、乾燥地植物資源バンク室、及び事務部で組織され、その運営は、教授会と運営委員会によって行われる。なお、鳥取大学技術部は平成 24 年度より組織が一元化され、1 つの部局となったが、これまでと同様、業務依頼及び技術支援による相互連携を図っている。

研究部門は、気候・水資源、生物生産、緑化保全、社会経済、保健医学の 5 研究部門から構成され、専任の教授 4 名、准教授 7 名、助教 4 名、国内客員 3 名、外国人客員 3 名が配置されている（平成 25 年 1 月時点）。また、平成 24 年度はテニュアトラック教員 1 名、プロジェクト研究員 10 名、日本学術振興会特別研究員 2 名が配置された。事務系には職員 12 名（事務職員 5 名、事務補佐員 7 名）、技術系には職員 9 名（技術職員 4 名、技術補佐員 5 名）が配置され、研究・教育の支援事務などを担当している。

共同研究、教育、刊行物

平成 24 年度における共同利用研究者（大学教員など）は 66 名、在籍学生は平成 24 年 10 月現在 22 名（博士課程 10 名、修士課程 10 名、学部学生 2 名）である。

共同研究に関する研究発表会は毎年開催しており、平成 24 年度は、12 月 1 日～2 日に当センターにおいて開催した。また、センター内外の乾燥地研究者によるセミナーも数多く開催されている。外国人客員研究員も定期的に講義形式のセミナーを開催している。

定期刊行物としては、鳥取大学乾燥地研究センター年報を発足以来毎年刊行し、センターの研究教育活動の紹介を行っている。

wind speed. His paper reporting this result is published in Geophysical Research Letters of American Geophysical Union (AGU) in 2011, and the paper was selected as an AGU Research Spotlight.

In April 2012, the Laboratory of Arid Land Plant Resources (ALPR) has been established to enhance activities as the Joint Usage/ Research Center at ALRC, especially to promote the joint research on arid land plants.

In December 2012, Tottori University was selected by MEXT for an “MEXT Grant for Formation and Development of Outstanding Hub Graduate Schools,” a subsidy for the cost of forming its research center.

In March 2013, the 11th International Conference on Development of Drylands (ICDD) was held in Beijing, China. As one of its host institutions, ALRC sent a large number of researchers to this three-day conference to give presentations.

In addition, ALRC was granted the MEXT Funds for the Development of Human Resource in Science and Technology “Promote Tenure-Track System.” In response, ALRC has employed a tenure-track assistant professor since March 2013.

Organization and Management Structure

ALRC consists of the Director, Vice Director, Faculty Meeting, Advisory Committee, Joint Research Committee, the Research Division, the Laboratory of Arid Land Plant Resources, and the Administration Department. The Faculty Meeting and the Advisory Committee operate the center. The Technical Departments of Tottori University integrated their organizations in 2012 to form one department, but as in the past, maintains mutual links based on business requests and technical support.

The Research Division is composed of five divisions: the Climatology and Water Resources Division, the Biological Production Division, the Afforestation and Land Conservation Division, the Socioeconomics Division and the Health and Medicine Division. As of January 2013, four full-time professors, seven associate professors, and four assistant professors, as well as three visiting national professors and three visiting international researchers were allocated to these research divisions. In addition, one tenure-track assistant professor, ten project researchers, and two JSPS fellowship researchers were added to our research teams in FY 2012. Moreover, twelve office staff (five full-time and seven part-time) and nine technical staff (four full-time and five part-time) supported ALRC’s research and education.

Joint Research, Education, Publication

In FY 2012, 66 joint researchers, mainly from national and private universities, were attached to ALRC. As of October 2012, we had a total of 22 students; ten doctoral students, ten master’s students, and two undergraduate students. ALRC holds the Joint Research Symposium every year. In FY 2012, we held the symposium on December 1 and 2 at the center. Seminars were often held by a large number of internal and external experts. Our visiting international researchers also periodically gave seminars.

Annual report has been published since the establishment of ALRC, which provides information and data about our research and education activities.

研修施設

平成 23 年 8 月には、学外の共同研究者や学生が研究及び研修のために宿泊できる研修施設（ゲストハウス）が完成。この施設は、ツインルーム 2 室、シングルルーム 4 室、研修室 1 室を備えている。

アウトリーチ活動

乾燥地研究センターでは、国内外や地域の人々にセンターを知ってもらうため、施設見学や出前講義などを積極的に受入れている。また、研究成果を広く社会に還元するため、一般市民や研究者を対象としたシンポジウム、パネル展等のイベントを開催している。平成 24 年度の主な活動は以下の通り。

- 日本地球惑星科学連合 2012 大会 (JpGU) の大学インフォメーションパネルに出展：平成 24 年 5 月 20 日～25 日、幕張メッセ国際会議場
- きみもなろう！「砂漠博士」：平成 24 年 8 月 11 日、参加人数 19 名
- 一般公開：平成 24 年 12 月 15 日、参加人数 38 名
- 黄砂プロジェクト公開講演会「鳥取発！黄砂研究の最前線」、パネル展：平成 25 年 2 月 1 日～5 日、とりぎん文化会館（鳥取市）、参加人数 103 名（講演会）



Guest House



Arid Land Research Center

Guest House

Guest house was built in August 2011, which is available for joint researchers and students who would like to stay ALRC premises for research activities and training. This accommodation facility has two twin rooms, four single rooms and one training room.

Outreach Activities

ALRC has been conducting various public outreach activities such as facility tours, exhibitions and lectures to promote and publicize ALRC activities both inside and outside Japan. In addition, ALRC has been holding many events such as symposiums and panel exhibitions to disseminate research results and achievements to public and outside researchers. We held the following activities in FY 2012.

- Exhibition and information panels of Tottori University at Japan Geoscience Union Meeting 2012 (20–25 May 2012, Makuhari Messe International Convention Complex)
- Educational program for elementary students “Let’s become a Dr. Desert” (11 August 2012)
- Open House Event (15 December 2012, ALRC)
- Panel exhibition and Open lectures “The Frontier of Asian Dust Research from Tottori” by Asian Dust Project (1–5 February 2013, Tottori Prefectural Hall.)



Arid Land Dome was constructed in 1998 to enhance the efficiency of research at ALRC.

(2) 研究部門

1) 気候・水資源部門

篠田 雅人 (気候学)

乾燥地における水・エネルギー循環を通じた広域的な気候と陸域生態系（農業生態系も含む）の相互作用を研究している。乾燥地由来の環境問題である黄砂発生過程の研究も行っている。

1. モンゴル草原における干ばつ実験 (図)
2. アジア・アフリカ乾燥地域における陸域生態系による気候メモリの動態 (科研費)
3. モンゴル国における干ばつ・ゾドの早期警戒システムの構築 (JICA プロジェクト) (図)
4. 黄砂発生過程と地表面 (土壌水分・積雪・植生) 状態 (ポスト GCOE プログラム、黄砂プロジェクト)
5. 干ばつに対して脆弱なアジア草原のホットスポットの特定 (科研費)



Drought experiment with a rain shelter in a Mongolian grassland during the summer of 2005

(2) Research Divisions

1) Climatology and Water Resources Division

Masato Shinoda (Prof., Climatology)

The climatological subdivision conducts research on eco-climate system dynamics in arid region; interaction between the large-scale climate and terrestrial ecosystems (including agricultural ecosystems) through water, energy, and carbon circulation. Focus is placed on climate change analysis in arid region, drought sciences, and early warning system of meteorological disasters. We also promote research on dust emission processes in Mongolia that are linked to the arrival of aeolian dust to Japan. Major study topics are as follows:

1. Drought experiment in a Mongolian grassland (supported by Grants-in-Aid for Scientific Research of the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan) (Fig.)
2. Climate memory dynamics of terrestrial ecosystems over the Asian-African arid region (Grants-in-Aid for Scientific Research of MEXT)
3. Developing an early warning system of drought and dzud in Mongolia (JICA project) (Fig.)
4. Developing a biogeophysical model simulating the dust emission processes (supported by the post Global Center of Excellence program for dryland science of Tottori University, Dust project)
5. Identifying hotspots on the Asian steppe that were vulnerable to drought (Grants-in-Aid for Scientific Research of MEXT)



Developing an early warning system of drought and dzud in Mongolia

木村 玲二 (気象学)

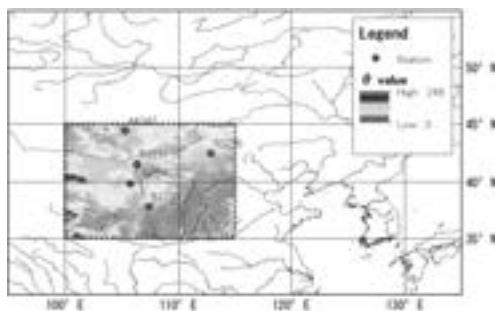
気象学分野では、以下のような研究を行っている。

- (1) 乾燥地における熱フラックスの定量的解明
- (2) 気象データとリモートセンシングデータを併用した地表面湿潤度のモニタリングとモデリング
- (3) 北東アジアにおいて植生がダストの発生を抑制する物理的メカニズム

これらの研究は、日本学術振興会による科学研究費(課題番号 21404007、20255001)、文部科学省特別経費事業(黄砂プロジェクト)および JAXA Global Change Observation Mission の援助によって、主として中国やモンゴル、エジプトで行われている。

本年度は、特に以下の研究で成果を得た。

1. 北東アジア地域の北緯 35~45°・東経 100~115° を黄砂発生源のターゲットエリアと位置づけ、1993~2002 年の 10 年を対象に、春季(3~5 月)におけるエリア内の砂塵嵐発生回数(DSF)と日本で観測される黄砂現象(ADE)との比較を行った。ADE はエリア内の DSF との相関が高く、本研究で定義したエリア内の砂塵嵐が日本の黄砂現象に与える影響が大きいことが示された。DSF は 7 m/s 以上と定義される強風の頻度と相関が高くなったが、エリア内の裸地の被覆率との間にも有意な相関が認められた。すなわち、エリア内における裸地の被覆率が大きくなると DSF は増加することが明らかとなった。
2. 2000 年~2011 年に日本で観測された黄砂現象(ADE)は黄砂発生源における砂塵嵐と有意な相関関係を示した。発生源における強風の頻度および土地被覆、特に裸地と植生地の被覆率は ADE に大きな影響を与えていることが示された。2000 年以降、ADE は減少傾向にあるが、発生源における植生の増加と対応していることが分かった。
3. 黄砂発生源における土壌表層の土壌水分が黄砂の発生に与える影響を AMSR-E による土壌水分プロダクトを用いて検討した(図)。
4. エジプトのダハラオアシスにあるラシュダ村において、2001 年から 2010 年までの政府管理井戸区域および村管理井戸区域の耕作の特徴を気象データと衛星データから特定した(図)。



Spatial distribution of surface soil water content using AMSR-E product

Reiji Kimura (Assoc. Prof., Meteorology)

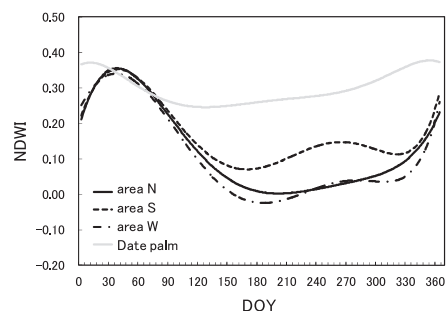
The meteorology subdivision conducts research mainly as follows:

- (1) Quantitative analysis of heat fluxes in arid land,
- (2) Monitoring and modeling of surface moisture by combining the meteorological and remote sensing data,
- (3) To make clear the physical mechanism for preventing the dust outbreak by vegetation in northeast Asia.

These studies are supported by the aid from Japan Society of the Promotion of Science Grants (KAKENHI 24510017), MEXT Project of Integrated Research (Asian Dust Project), and JAXA Global Observation Mission, especially in China, Mongolia, and Egypt, respectively.

In fiscal year 2012, I obtained results from following researches:

1. The dust source area in northeast Asia was identified, and the relationship between the Asian dust event over Japan (ADE) and dust outbreaks in the target area was examined during the spring time from 1993 to 2002. The annual change in the number of ADE agreed with the Dust Storm Frequency (DSF) in the target area. Even though strong wind has a profound effect on dust storms, coverage of the bare land in April also affected dust storms in the target area
2. The relationship between the strong wind and land cover in dust source regions and the ADE was analyzed during the spring of 2000 to 2011. The annual change in the number of ADE agreed well with DSF. Strong wind has significant effect on ADE, and coverage of bare land and vegetation surface in April and May are also related to the number of ADE. The coverage of bare land decreased by 4%; in contrast, vegetation surface reducing dust outbreaks increased 4% in the 12 years from 2000 to 2011. Increasing trend of vegetation corresponded to the decreasing trend in ADE
3. The effect of soil-water content in dust source regions on the Asian dust event was examined using the AMSR-E soil water product from 2003 to 2011 (Fig.)
4. Cultivation features throughout the government and local well districts are examined using meteorological and satellite data from 2001 to 2010 and the interview in Rashda Village, Dakhla Oasis of Egypt (Fig.)



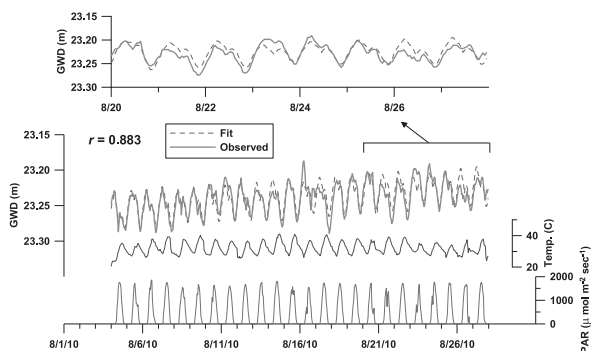
Seasonal change of vegetation water content using satellite data in Dakhla oasis Egypt.

安田 裕 (水文学)

水文学分野では乾燥地における水循環に取り組んできている。本年度はスーダンの調査地で、1) 外来植種メスキートの地下水からの吸水特性、2) ワジの水収支、3) 降水量時系列解析を実施した。

スーダンの調査については、科学研究費・基盤研究(B)：2011～2015 (代表者：安田 裕)「乾燥環境下における外来植種の排他的侵入特性と地下水文系のヘテロ性との関連」により、ナイル川流域のワジにおいて物理探査・ボーリングなどの調査を行った。ワジの100 m 深近傍には著名なヌビア帯水層が存在するが、50 m 深までに飽和水分域(宙水)が存在していた(図)。また、外来侵入植種メスキートの群落直下の地下水位を観察し、吸水特性を考察した。さらにスーダン全土の11 観測点の降水量につき季節性、周期性の解明を行った。

スウェーデン・ルンド工科大学・水資源工学科には2 度訪問した。乾燥地非均一土壌中の移動現象についての研究をさらに発展させた。今回は、エジプト・チュニジアで実施された現地実験結果の解析、さらには中国、黄河源流域の気象・水文解析、天山山脈氷河の体積変化に取り組んだ。



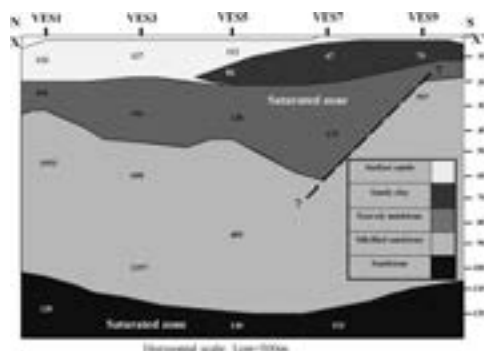
Numerical simulation for fluctuation of groundwater depth due to water uptake by mesquite. Groundwater table declined in the daytime. Groundwater level recovered around noon because of the midday depression. The simulation model followed the fluctuation well ($r=0.883$).

Hiroshi Yasuda (Assoc. Prof., Hydrology)

The hydrology subdivision researches on water circulation in arid land. In fiscal year 2012, the focus was placed on Sudan and studies were conducted on: 1) characteristics of water uptake from groundwater by alien vegetation, mesquite; 2) water budget of wadi (ephemeral stream); 3) analysis of precipitation time series.

In Sudan, research activities such as geophysical survey and boring were performed at a wadi basin under a project by Japan Society of the Promotion of Science Grants-in-Aid for Scientific Research (B), 2011–2015, 'Relationship between the exclusive invasion of alien vegetation, mesquite and heterogeneity of sub-surface zone in arid environment' (Project Leader: H. Yasuda). There is a high moisture zone at 20–50 m depth in addition to the Nubia Aquifer at 100 m depth. Groundwater level beneath a mesquite bush was observed and the water uptake property was considered. And seasonal and periodical characteristics of 11 rainfall stations over Sudan were clarified.

Two visits were paid to Department of Water Resources Engineering, Lund Institute of Technology, Sweden, and a study on transportation in heterogeneous soil in arid land further developed. Analyses on results of field experiments performed in Egypt and Tunisia were also tackled. Hydro-meteorological analysis on the source region of Yellow River was done and volume fluctuation of glacier at the Tianshan mountains were studied.



Geophysical survey of a wadi basin. The Nubia aquifer at 100 m depth. High water content zone at 20–50 m depth.

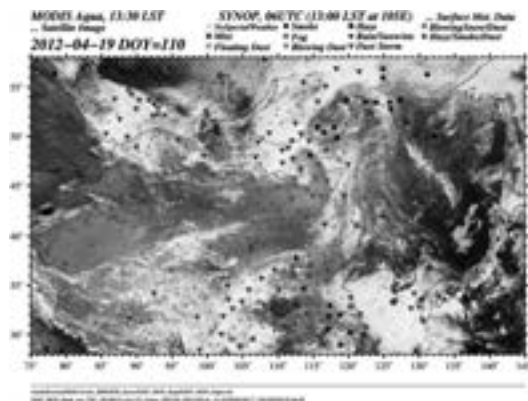
黒崎 泰典 (ダスト気候学)

ダスト粒子 (日本では黄砂として知られている細かい土壌鉱物粒子) は乾燥地域や耕作地などにおいて強風によって舞い上がり、より細かい粒子は自由対流圏の風によって長距離輸送される。サハラ砂漠起源のダストはヨーロッパやアメリカ大陸において、ゴビ砂漠やタクラマカン砂漠起源のダストはグリーンランド、ハワイ、米国西海岸などにおいてしばしば観測される。ダストは人間生活に大きく影響しているが、発生域と風下域で影響タイプが異なる。発生域付近では気象災害の側面が強く、人や家畜の死亡・行方不明、建築物損壊などの被害が報告されている。発生地域から遠くなるに従い、健康影響、酸性雨中和、海洋生態系への影響、放射過程・雲凝結過程を介した気候への影響といった環境影響の側面が強くなる。ダスト気候学分野では、(1)日々のダスト空間分布モニタリング、(2)発生原因解明、(3)日本に飛来するダスト(黄砂)の沈着量、発生源解明を課題とし、本年度は以下のことを行った。

課題(1)では、気象台観測データとMODIS衛星画像を用いた東アジア域準リアルタイムダストモニタリングシステムの維持更新を行い、世界各地のダスト研究者とダスト発生・輸送経路の議論を行った。

課題(2)では、「東アジア砂漠化地域における黄砂発生源対策と人間・環境への影響評価」(黄砂プロジェクト)において、ゴビ砂漠北部のツォクトオボー(モンゴル)に設置した黄砂発生観測システムの維持管理を行い、砂塵発生量、風速、土壌水分量などの観測を行った。JSPS組織的な若手研究者等海外派遣プログラム「乾燥地科学拠点における国際人材養成」によって、モンゴルに2ヶ月間滞在し、衛星画像で確認した黄砂発生地域の土壌サンプリング、周辺環境調査を行った。

課題(3)では、乾燥地研究センター共同研究「日本における黄砂の沈着量の観測」(代表:長田和雄・名古屋大学)において、ダスト沈着量観測を乾燥地研究センター屋上で実施した。この観測において、課題(1)で作成した衛星画像を観測日特定に活用した。課題(2)でサンプリングしたモンゴル黄砂発生源土壌を科研費「一粒の石英粒子のカソードルミネッセンス分析によるダスト供給源推定法の開発」(代表:長島佳菜・海洋研究開発機構)に提供し、黄砂発生源土壌特性解明に活用した。



Dust distribution on April 19, 2012. This image was produced by the near-real time east Asia dust monitoring system.

Yasunori Kurosaki (Assist. Prof., Dust Climatology)

Mineral dust particles are blown up by a strong wind in arid and agricultural areas, and they are transported over a long distance by wind in free troposphere. We often observe that dust particles produced in the Gobi and the Taklimakan travel to Greenland, Hawaii, the North America, etc. Dust largely affects human lives, but types of the effect are different by place. In source areas, it works as disaster which leads to death and disappearance of human and livestock, damages on architectural facility, etc. In downwind areas, it works as a factor of health impact such as respiratory disease and as a factor of environment change such as neutralization of acid rain, marine ecosystem change, climate change, etc. The dust climatology subdivision has three subjects: (1) monitoring of dust distribution, (2) clarification of dust production causes, and (3) clarification of the amount and the source regions of deposited dust in Japan. In fiscal year 2012, I made researches described as below.

On the subject (1), I maintained the near-real time east Asia dust monitoring system using MODIS satellite images and meteorological observatory data. Discussions were made on emission places and transportation routes of dust with researchers in Japan and other nations.

On the subject (2), I maintained a dust emission observation system, which was set up in Tsogt-Ovoo in the northern part of the Gobi Desert of Mongolia under Project Asian Dust by Tottori University and observed dust emission. I made soil samplings and environmental surveys at several dust source areas in Mongolia under JSPS Institutional Program for Young Researcher Overseas Visits.

On the subject (3), I made samplings of deposited dust on the roof of ALRC building under an ALRC joint research (PI: Osada Kazuo, Nagoya Univ.). I decided on sampling days using the dust monitoring system of the subject (1). I utilized the soil sampled in Mongolian dust source areas in the subject (2) for clarification of the soil characteristics in dust source areas in collaboration with Dr. Nagashima (JAMSTEC) under her KAKENHI program.



Dust emission observation system set up in Tsogt-Ovoo Mongolia located in a northern part of the Gobi Desert.

2) 生物生産部門

恒川 篤史 (保全情報学)

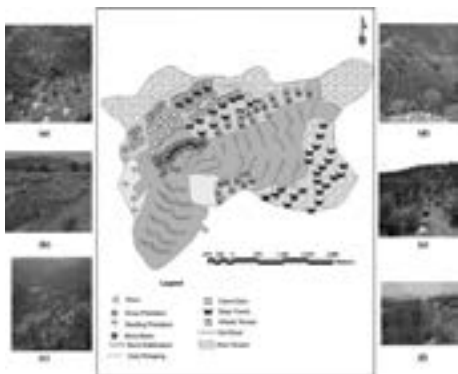
保全情報学分野では、乾燥地における植物生産および生態系変化のモニタリングとモデリングを中心的課題としている。特に水やダストを介しての大気と陸域（植生と土壌）の間の相互作用の解明や、乾燥地における生態系・地域社会の持続可能性を評価する手法の開発に力を入れている。そのため数値モデル・リモートセンシング・GISなどの情報技術とフィールドでの観測、乾燥地研究センターにおける施設実験などを組み合わせながら、以下のような研究を進めている。

1. 生態系プロセスモデルを用いた環境応答の予測
2. リモートセンシング・GISを用いた生物生産力の広域推定
3. 乾燥地における持続可能性の評価手法の開発
4. バイオ燃料植物の生産力と環境影響の評価

本年度は、主に以下のような成果が得られた。

1. 統合的流域管理 (integrated watershed management : IWM) は先進的な土地管理アプローチであり、エチオピア北部のティグレイでは広く実施されている。下図の地区では、半月工法などの小型のウォーターハーベスティング、チェックダム、家畜よけのエクスクロージャー、トレンチ (排水溝) と組み合わせたストーンライン、トレンチと組み合わせた植林、ガリー (侵食谷) の修復といった6つの技術を流域内の適所に導入している。そのIWMの効果を解析した結果、表面流去とシート・ガリー侵食が、それぞれ27%、89%減少し、ガリー溝が改善されたことが示された。(Environmental Monitoring: Haregeweyn, Berhe, Tsunekawa, Tsubo & Meshesha, 2012)
2. 能動型・受動型マイクロ波リモートセンシングを用いた凍結・融解過程の始期と終期を検出する方法が提案された。対象地域では、輝度温度は各年の最初の180日間増加する傾向を示した。後方散乱は、凍結地域では減少傾向を、非凍結地域では増加傾向を、砂漠地域では安定した傾向をそれぞれ示した。

(IEEE Geoscience and Remote Sensing Letters: Han, Tsunekawa & Tsubo, 2012)



Integrated watershed management (IWM) in Tigray region of northern Ethiopia.

2) Biological Production Division

Atsushi Tsunekawa (Prof., Conservation Informatics)

The conservation informatics subdivision conducts research on the monitoring and modeling of the plant production and ecosystem change in the dry lands. Particular efforts are being made to clarify the interaction between the atmosphere and the land surface (vegetation and soil) through water and dust, and to develop methodologies for evaluating the sustainability of ecosystems and local communities in dry lands. The research of the subdivision is driven by combining the use of information technologies such as numerical modeling, remote sensing and geographic information systems (GIS); field observations; and experiments using ALRC's facilities for the following topics.

1. Prediction of environmental response using a process-based ecosystem model
2. Regional estimation of biological productivity using remote sensing and GIS
3. Development of methodologies for evaluating sustainability in drylands
4. Evaluation of productivity and environmental impacts of biofuel plants

The main research achievements in the fiscal year 2012 are as follows:

1. Integrated watershed management (IWM) is an advanced land-management approach that has been widely implemented in Tigray region of northern Ethiopia. It was found through analysis on the impacts of IWM in Tigray that runoff and sheet and rill erosion decreased by 27 and 89%, respectively, and gully channels were reclaimed. (*Environmental Monitoring: Haregeweyn, Berhe, Tsunekawa, Tsubo & Meshesha, 2012*)
2. A new method to detect the beginning and end of the freeze-thaw transition using active and passive microwave remote sensing data was proposed. In the study regions, brightness temperature showed an increasing trend during the first 180 days of the year, but backscatter trends decreased in frozen ground regions, increased in nonfrozen ground regions, and were steady in desert regions. (*IEEE Geoscience and Remote Sensing Letters: Han, Tsunekawa & Tsubo, 2012*)



Community participation in land management in Tigray, northern Ethiopia.

辻本 壽 (分子育種学)

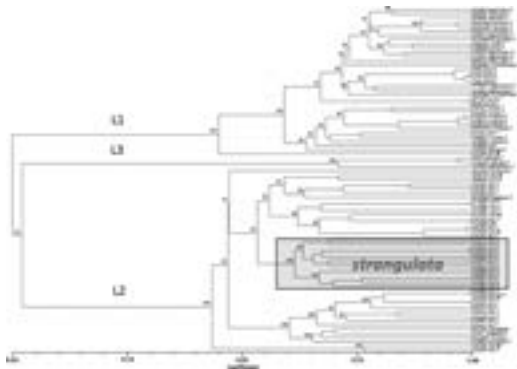
現在 70 億人の世界人口は 50 年後には 90 億人を上回るが、地球の環境変動下で食糧をいかに増産するかが大問題である。分子育種学分野では、乾燥地において主要作物であるコムギに乾燥耐性、高温耐性等の環境ストレス耐性を付与して安定生産できる品種、さらに水や肥料等の資源の投入を削減し、なおかつ環境に負荷をかけにくい品種の開発に関連する以下の研究を行っている。

- コムギ近縁野生植物の探索
- 異種染色体を保有するコムギ系統の開発
- コムギの環境ストレス耐性および節肥性の選抜
- 品質や栄養価の高いコムギの研究
- 異種およびコムギ染色体の組換えに関する研究
- 種間交雑法および異種染色体同定法の改良
- ストレス耐性作物の開発

これらの研究は、中国、モロッコ、チュニジア、スーダン、メキシコ、アフガニスタン等にある研究機関、および国内の大学・研究機関との共同研究で行っている。

本年度は、特に以下の研究で成果を得た。

1. コムギ近縁種の分子解析：近縁野生種タルホコムギの多様性を解析するための DArT マーカーのアレーを開発した。これを用いて、タルホコムギの種内の集団構造を明らかにした。
2. 選抜集団の開発：タルホコムギのゲノムをもつ合成コムギをパンコムギに交配し、野生種の多様性を含む実用パンコムギの集団を作り、「多重合成コムギ派生系統」と名付けた。
3. 超遠縁の雑種系統の育成：乾燥ストレスに強いパールミレットの花粉を様々な麦類に交配した結果、エンバクとの間で安定した雑種ができることを明らかにし、胚培養法で個体を得た。
4. 同祖染色体対合を検出するための系統開発：コムギに 2 種のハマニク属植物の染色体を導入し、野生植物とコムギ染色体の組換えに影響する因子を検出するための実験系統と手法を開発した。
5. 植物遺伝資源探索：グルジアおよびカザフスタンにおいてコムギおよび近縁野生植物の系統を収集した。



Phylogenetic tree of the 81 accessions of *Ae. tauschii* by 4,449 DArT markers.

Hisashi Tsujimoto (Prof., Molecular Breeding)

The world population that is currently about 7 billion will be more than 9 billion after 50 years. How to produce food for the increasing population under changing climate is a biggest issue for human being. My research is about stable production of wheat under drought, heat and other environmental stresses by genetical modification of the crop. In addition, intending to produce environment-harmonizing wheat varieties, I am conducting researches on water-saving and fertilizer-saving traits. Followings are the topics of my laboratory.

- Exploration of wheat related species
 - Production of wheat lines possessing alien chromosomes
 - Selection of wheat lines showing environmental-stress tolerance or fertilizer-saving traits
 - Studies on high quality or mineral-rich wheat
 - Studies on meiotic recombination between wheat and alien chromosomes
 - Improvement of methods for interspecific hybridization and identification of alien chromosomes in wheat lines
 - Genetic analysis of stress-tolerant plants other than wheat
- These researches are being conducted with overseas research institutions in China, Morocco, Tunisia, Sudan, Mexico, Afghanistan etc. and those in Japan.

In fiscal 2012, I obtained results from following researches:

1. Molecular analyses of wheat-related species: We developed an array for DArT analyses of a wheat-relative, *Ae. tauschii*, and analyzed the population structure of this species
2. Production of selection population: We crossed the synthetic wheat having the genome of *Ae. tauschii* and produced populations including its diversity. These breeding materials were named 'MSD population'
3. Production of far-related hybrid: We crossed pollen of pearl millet with various wheat-related species and obtained stable hybrids with oat by embryo rescue
4. Production of homoeologous recombination indicator: By introduction of two types of *Leymus* chromosomes we obtained wheat lines showing homoeologous recombination frequency
5. Plant explorations: I joined the missions to Georgia and Kazakhstan and obtained wheat and related species



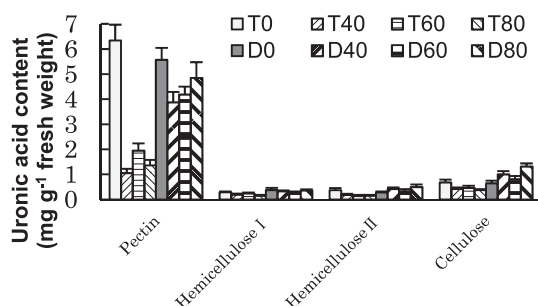
Wheat field with mixture of weed rye. (Georgia, July 20, 2012)

安 萍 (植物生理生態学)

植物生理生態学分野では、乾燥地における植物および作物の生理生態学および適正栽培技術の開発を中心的課題としている。特に、植物および作物の環境ストレスに対する応答とその耐性機構の解明、乾燥地農業における水利用効率向上技術の開発、作物の塩および乾燥ストレス緩和技術の開発に力を入れて、国内における基礎研究と国外の乾燥地の現場における応用研究を組み合わせた研究を進めている。具体的には、以下の課題について進めている。

- ダイズおよびトマトの耐塩性機構の解明
- 作物の根と環境ストレス耐性との関係の解明
- 中国渤海湾沿岸地域における経済価値の高い塩生植物の探査
- 塩水灌漑による栽培技術の開発
- 中国の砂漠における植物の分布調査

本年度の国外での共同研究のため、中国河北省林業科学院を訪問し、長根苗を利用した砂地での植林技術の開発について現地研究者との打ち合わせを行った。また、ナイジェリアのカラバー大学を訪問し、塩水を利用した作物の灌漑技術の開発について現地研究者との打ち合わせを行った。



Uronic acid contents in four compositions of root cell wall under 0, 40, 60 and 80 mM NaCl treatments in soybean cultivars of Tachiyutaka (T) and Dare (D).

Ping An (Assoc. Prof., Plant Eco-physiology)

The plant eco-physiology subdivision conducts researches on the elucidation of eco-physiological characteristics of plants and crops and development of appropriate cultivation technology in arid lands. Particular efforts are being made to clarify the responses of plants and crops to environmental stresses and relevant mechanisms. The purpose of the studies is to develop cultivation technology for enhancement of water use efficiency and mitigation of drought and salinity stresses in dryland agriculture with combining the basic research in Japan using the ALRC's facilities and applied research at real fields in drylands. The current studies are:

- Salt tolerance mechanisms in soybean and tomato
- Relationship between root and plant salt tolerance
- Investigation of halophytes with high economic value in Bohai Bay in China
- Application of saline water for crop irrigation
- Vegetation distribution in the desert of China

Overseas research activities during the fiscal year 2012 include visits to China and Nigeria. One visit was to Hebei Academy of Forestry Science, for the cooperative study on re-vegetation in sandy land using long-root seedlings. Another visit was to University of Calabar in Nigeria for the cooperative study on utilization of saline water for crop irrigation.



Wild halophytes in the saline soils along Bohai Bay in China.

坪 充 (植物生産学)

植物生産学分野では、作物生態生理学、微気象学、生態気象学、農業気象学などの広範囲の分野で研究活動を行っている。シミュレーション・モデリング手法を研究に取り入れており、フィールド調査や屋内実験を基礎とした植物成長・生産モデルの構築に力を入れている。研究は、以下の課題について進めている。

- 干ばつに対する植物応答の解析
- 乾燥地における植物生産のモデリング
- 干ばつ早期警戒システムの構築

今年度の主要な研究活動は、南アフリカの半乾燥草地のための植物生産モデルの開発を行った。

Mitsuru Tsubo (Assoc. Prof., Plant Production Science)

Research activities of the plant production science subdivision are carried out in a wide range of fields such as crop ecophysiology, micrometeorology, ecoclimatology and agrometeorology. A research technique employed in the subdivision is simulation modelling; field work and indoor experiment are also conducted to build and test plant growth and production models. The main research topics are:

- Plant response to drought
- Modelling plant production in drylands
- Development of a drought early warning system

The major research activity during the fiscal year was to develop a plant production model for semi-arid grassland of South Africa



Typical grassland in South Africa (Bloemfontein in March 2010)

エリタイブ ハボラ E. アミン (生物工学)

バイオテクノロジーは、気候変動や増加する世界人口の食糧安全保障等、表面化した課題に対処するための最も実行可能な解決策の1つであると考えられる。生物工学分野では乾燥や塩等の非生物学的ストレス耐性のための植物分子生物学および遺伝子工学の研究を行っている。その目的は乾燥地でのストレス環境下での農作物の適応力を高め、安定した生産性を保障し、土地と水の利用効率を高めることである。

生物工学分野は次の3つの課題解決のため、遺伝子や染色体レベルでの高度な技術を用いて研究を行っている。

1. 乾燥地の環境、特に干ばつ、高温および塩害に適応する新奇遺伝子および遺伝子ネットワークの同定
2. 遺伝子工学によるストレス耐性および高度適応性遺伝子組換え植物の作成
3. 栽培種および近縁野生種に由来する育種素材の評価

ここでは、重要作物である、ジャガイモ (*Solanum tuberosum*)、イネ (*Oryza sativa*)、コムギ (*Triticum aestivum*) およびそれらの野生植物を研究材料として用いている。また、タバコやシロイヌナズナ等のモデル植物を新奇ストレス耐性遺伝子の試験をするために利用している。

本分野では、本年度は博士課程と修士課程学生の指導も行った。また、米国カリフォルニア大学デービス校植物科学科で6ヶ月間、コムギの塩ストレス耐性に関する研究を行うため、滞在した。さらに、中国、米国、オーストラリアでの国際ワークショップと会議に参加した。



Different genetically modified plants are used to combined several new genes into one plant by cross hybridization.

Amin E. Eltayeb Habora (Assist. Prof., Biotechnology)

Biotechnology is regarded as one of the most viable solutions to deal with the emerging challenges such as climate change and global food security for the growing world population. The biotechnology subdivision conducts research on plant molecular biology and genetic engineering for tolerance to abiotic stress such as drought and salinity stresses. The aim is to enhance adaptation of agricultural crops to the dryland's stressful environments, assure yield stability and increase land and water resources use efficiencies.

Biotechnology subdivision adopts sophisticated technologies that operate at the gene and chromosome levels to fulfill following three goals:

1. Identification of novel genes and genetic networks for adaptation to drylands environments, particularly drought, heat or salt affected lands
2. Production of stress-tolerant and highly adaptable genetically modified plants using genetic engineering
3. Evaluation of breeding materials derived from cultivated and wild relatives of crops

I carry out research on important cultivated crops such as potato (*Solanum tuberosum*), rice (*Oryza sativa*) and wheat (*Triticum aestivum*) and its wild relative species. I also use model plants such as Tobacco and Arabidopsis for testing new stress tolerance genes.

During fiscal year 2012, this subdivision has contributed to the supervising research of Ph.D and M.Sc. students. Overseas activities during the fiscal year included a seven month research visit to the Department of Plant Science of the University of California, Davis (USA) to conduct research on salt stress tolerance of wheat crop and participation in international workshops and conferences in China, USA and Australia.



Preliminary trails of transgenic wheat carried under fully controlled conditions.

3) 緑化保全部門

山中 典和 (緑化学)

緑化学分野では植物生態学に基礎をおいた乾燥地域の緑化及び砂漠化土地の生態系修復に関する研究を行っている。主要な研究テーマは以下のようである。

- 乾燥地における植物群落の生態学的研究
- 樹木の耐乾・耐塩性に関する生理生態学的研究
- 乾燥地の生態系修復に関する研究

これらの研究は、中国、モンゴル、アメリカ等にある研究機関、および国内の大学・研究機関との共同研究で行っている。

本年度は、特に以下の研究で成果を得た。

1. 東アジア砂漠化地域における黄砂発生源対策と人間・環境への影響評価 (黄砂プロジェクト; 文部科学省特別経費): 中国内モンゴルクブチ砂漠において、植栽された小葉楊 (*Populus simonii* Carr.) の水利用、成長量に与える埋砂の影響を明らかにした。
2. 乾燥地緑化への応用を目指した耐乾・耐塩性植物の浸透調整能の解明とその向上 (科学研究費・基盤研究 (B)): 中国内蒙古自治区の毛烏素沙地で砂丘固定に利用されるヤナギ属樹木の *Salix psammophila* C. Wang et Ch. Y. Yang と *S. matsudana* Koidz. について、塩ストレスが成長、光合成、および葉内のベタイン蓄積に及ぼす影響を明らかにした。また、沖縄県西表島に生育する耐塩性樹木のマングローブ類 (オヒルギ、ヤエヤマヒルギ、マヤブシキ、ヒルギダマシ) について葉内浸透調節物質と陽イオン濃度を明らかにした。
3. 北東アジアの乾燥地生態系における生物多様性と遊牧の持続性についての研究 (環境省環境研究総合推進費): モンゴル国マンダルフゴビ地域で “key-resources” 群落の生育地特性に関する野外調査を行い、多年生イネ科草本の *Achnatherum splendens* 群落の群落構造と土壌特性の関係を明らかにした。
4. 海水による冠水が東日本太平洋沿岸域に分布する樹種の生理・生存に及ぼす影響: 海水による冠水を受けた樹木の枯死課程、植物体における塩類集積、樹液流動態を明らかにするための実験を行い、東日本の海岸林に生育する樹木の耐塩性を評価した。



Vegetation survey in Mandal Gobi, Mongolia.

3) Afforestation and Land Conservation Division Norikazu Yamanaka (Prof., Revegetation Science)

The revegetation science subdivision conducts research on the revegetation in arid areas and ecosystem restoration of desertified lands based on plant ecology. Main research topics of the subdivision are as follows:

- Ecological studies on plant communities in arid lands
- Eco-physiological studies on drought and salt tolerance of woody plants
- Studies on the ecosystem restoration in arid lands

These researches are being conducted with research institutions in China, Mongolia, USA, etc. and those in Japan.

In fiscal year 2012, I obtained results from following researches:

1. Assessment and Control of Dust Emission in Degraded Drylands of East Asia (Project Asian Dust, Special Project Expenses by MEXT): We elucidated the effects of sand burial on water use and growth of Simon poplar (*Populus simonii* Carr.) in Kubuqi desert, Inner Mongolia of China
2. Elucidation of osmo-regulation mechanisms and improvement of drought and salt tolerance of plants for revegetation in arid areas (JSPS Grants-in-Aid for Scientific Research (B)): We elucidated the growth, photosynthesis, cation distribution and betaine accumulation of *Salix psammophila* C. Wang et Ch. Y. Yang and *S. matsudana* Koidz., which are frequently used for sand dune fixation in Inner Mongolia of China, under saline condition. We also elucidated cations and osmolytes content in leaves of *Bruguiera gymnorrhiza*, *Rhizophora stylosa*, *Sonneratia alba*, and *Avicennia marina* growing on Iriomote Island of Okinawa.
3. Biodiversity of dryland ecosystem and sustainability of nomadic production in Northeast Asia (Environment Research and Technology Development Fund, Ministry of the Environment): Field researches on habitat characteristics of “key-resources” community in dry land were conducted in Mandal Gobi of Mongolia. We elucidated the relations between community structure of *Achnatherum splendens* and soil conditions.
4. Effects of sea-water flooding on physiology and survival of woody plants distributed along the coastal area of the Pacific Ocean in eastern Japan: Experiments on dying process, salt accumulation in plant organs and sap flow dynamics of woody plants flooded by sea water were conducted and evaluated the salt tolerance of woody plants distributed along the coastal area in eastern Japan.



Experiments on salt tolerance of woody plants.

藤巻 晴行 (土壌保全学)

乾燥地・半乾燥地における塩類集積の数値予測と土壌劣化(土壌侵食、塩類集積)の防止と修復を中心的な研究課題としている。塩類集積の防止および修復には水の確保が要であるため、節水灌漑や排水の再利用に関する研究にも注力している。昨年度は、主として以下の研究に取り組んだ

1. JST-JICA 地球規模課題対応国際科学技術協力事業 (SATREPS)「ナイル流域における食糧・燃料の持続的生産」に係る研究活動
2. 植物の生長モデルと天気予報を用いた灌漑水量の決定

上記1については節水策の評価のための大面積圃場実験、農業排水を利用したバイオ燃料生産実験、暗渠排水システムの評価に関する調査活動、燃料作物(ヒマワリとナタネ)の耐乾性、耐塩性の評価のためのポット実験などに取り組んだ。2については、センター内圃場とチュニジア乾燥地域研究所の圃場で栽培実験を行った。2次元の点滴灌漑水量決定シミュレーションモデルを作成し、チュニジアでの実験に適用した。その数値モデルを本センターのウェブサイトで公開した。

http://www.alrc.tottori-u.ac.jp/fujimaki/download/WASH_2D/

また、以下のような海外活動を行った。

- 1) 「ナイル流域における食糧・燃料の持続的生産」の遂行のための8回、延90日のエジプト出張
- 2) ITP 学生研究の根群分布調査ならびに水分計の現地校正実験の指導のためのチュニジア出張
- 3) 10月の米国土壌科学国際会議での研究発表
- 4) ITP ディフェンスの審査員として中国蘭州市に出張
- 5) 第11回 ICDD への参加のため中国北京市に出張



Root sampling at barley field of IRA, Tunisia

Haruyuki Fujimaki (Assoc. Prof., Soil Conservation)

The subdivision of soil conservation studies on the prediction of salt accumulation and soil erosion and development of methods to prevent and remedy soil degradation in arid regions. Studies for water saving in irrigation and reuse of wastewater are also being carried out, since water is required for removing excess salts.

The main research activities in the fiscal year 2012 were as follows:

1. JST-JICA project (SATREPS), "Sustainable systems for food and bio-energy production with water-saving irrigation in the Egyptian Nile basin",
2. Determination of irrigation depths using a numerical model and quantitative weather forecast.

Regarding topic 1, (i) large scale field experiment for evaluation of water saving methods, (ii) cropping experiment for production of biofuel using agricultural drainage water, (iii) investigation for evaluation of tile drainage system, and (iv) pot experiment for evaluating drought and salinity tolerance for biofuel crops (castor bean), (v) salt removal using a cotton sheet, were mainly carried out.

I performed field experiments in ALRC and Tunisia for topic 2. Two-dimensional simulation model for determining irrigation depth of drip irrigation was developed and it was applied to the experiment. I started distributing the model, WASH_2 D, on our website:

http://www.alrc.tottori-u.ac.jp/fujimaki/download/WASH_2D/

Overseas research activities during the fiscal year were:

- 1) Visits to Egypt for "Sustainable systems for food and bio-energy production with water-saving irrigation in the Egyptian Nile basin" for 90 days in 8 trips,
- 2) Visits to Tunisia to supervise root sampling and calibration of soil moisture sensor for the ITP program,
- 3) Oral presentation in ASA-CSSA-SSSA 2012 International Annual Meetings in USA,
- 4) Attendance to defense of ITP program held in CAREERI, Lanzhou, China,
- 5) Attendance to 11th International Drylands Development Conference, 18-21 March, China.



Cotton sheet to remove salts from surface layer

伊藤 健彦 (動物生態学)

動物生態学分野では、乾燥地に生息する動物の生態学および生態系や生物多様性の保全を中心的課題としている。特にモウコガゼルやアジアノロバなどの中央アジアに生息する大型野生草食動物の生態学的・保全学的研究に力を入れている。衛星追跡や衛星画像解析、地理情報システム (GIS)、現地環境調査等を組み合わせて、大型野生動物の長距離移動の実態や移動・生息地選択要因の解明、野生動物への気象条件の年変動や人工構造物の影響の評価等を行っている。

本年度はモンゴルの野生哺乳類の大移動に関する新たなプロジェクトを開始した。本プロジェクトの目的は大規模鉱山開発に伴う新規道路・鉄道建設前の野生有蹄類の生息地利用を把握し、建設後の影響評価を行うことである。そのために夏と冬にモウコガゼルの生息地の環境調査を行った。

国外での研究活動として、現地調査と海外派遣プログラムでモンゴルを2回訪問した。

本年度は特に以下の研究で成果を得た。

1. モウコガゼルの遺伝子構造：モウコガゼルの遺伝子構造は大きく2つのグループに分けられたが、生息地分断化が懸念されている国際鉄道の両側での違いは現時点では認められなかった。
2. 野生有蹄類の生息地分断化：モウコガゼルとアジアノロバの衛星追跡により、両種の移動に対する国際鉄道とモンゴル-中国国境の強いバリア効果を確認した。野生有蹄類による鉄道および国境付近の利用は冬に多く、食物が乏しい季節に障害物を越えて環境条件の良い地域へ移動できないことの影響が懸念される。
3. モウコガゼルの移動パターン：多個体のモウコガゼルの移動パターンを解析し、移動パターンには同種内でも季節移動型や遊動型など複数のタイプが存在することを示した。



Mongolian gazelles and their habitat in winter

Takehiko Ito (Assist. Prof., Animal Ecology)

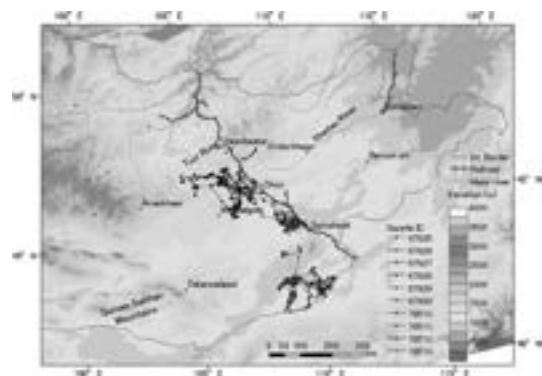
The Animal Ecology Subdivision conducts research on the ecology of wild animals and conservation of ecosystem and biodiversity in drylands. Main targets are ecological and conservational studies on wild large herbivores, such as Asiatic wild ass and Mongolian gazelle, inhabiting central Asia. We use satellite tracking to describe their long distance movements, and combine the use of remote sensing, geographic information systems (GIS), and field observations to analyze factors of their habitat selection and movement, and influences of climate fluctuation and artificial constructions on them.

We started a new project on conservation of great migration of wild mammals in Mongolia in the fiscal year 2012. The objectives of the project are to examine current habitat use of wild ungulates before the construction of new roads and railroads to permit big mining projects and to evaluate influences of such new structures on them. We surveyed environmental conditions of the habitat of Mongolian gazelles in summer and winter.

Overseas research activities during the fiscal year include field researches and scientific exchanges in Mongolia.

In this fiscal year, we obtained and published results on the following researches:

1. Genetic structure of Mongolian gazelles: Mongolian gazelles were divided into two genetic groups, but no difference was found between both sides of the international railroad that can possibly cause habitat fragmentation of wild ungulates.
2. Habitat fragmentation of wild ungulates: We confirmed strong barrier effect of the international railroad and borders between Mongolia and China on movements of Mongolian gazelles and Asiatic wild asses by satellite tracing. Tracked ungulates used closer areas to the anthropogenic structures during winter, suggesting that the structures impeded their movement to better sites during food limited season.
3. Movement pattern of Mongolian gazelles: We analyzed movement patterns of Mongolian gazelles and showed that the movement patterns of gazelles were divided into several types such as regular migration type and nomadic type.



Movements of Mongolian gazelles captured on the southwestern side of the railroad. (Ito et al. 2013, PLoS ONE)

谷口 武士 (微生物生態学)

微生物はマイクロレベルの非常に小さい生物であるが、地球上のバイオマスや機能としては非常に大きく、グローバルスケールでの炭素や窒素の動態にも深く関与している。また、植物の定着や土壌の形成に大きな役割を果たす微生物も存在するため、これらの微生物の役割を解明し、乾燥地の環境修復への利用に関する研究を行うことは非常に重要である。このような背景から、微生物生態学分野では、主に乾燥地の環境修復への微生物利用を目指して研究を行っている。また、ミクロスケールからマクロスケールの様々な規模で観察される現象や問題の解明、あるいは解決に向けて、微生物（細菌や菌類など）に着目した研究を行っている。

主な研究テーマは下記の通りである。

- ストレス条件下における植物—微生物共生関係の解明と環境修復への利用
- ストレス条件下で植物に有用な複合微生物系の探索
- 黄砂発生源地域における菌根菌の土壌団粒形成
- 乾燥地における微生物バイオマスと土壌呼吸の関係

これらのテーマについて、アメリカ、中国、モンゴルを中心に共同研究を行っている。

本年度は主に以下の研究で成果を得た。

1. アメリカカリフォルニアの半乾燥地における夏の降雨が外生菌根菌のバイオマスや群集構造に与える影響について調査を行った。外生菌根菌のバイオマスは降雨の後、緩やかに増加し、7日後には1.5~2倍に達した。外生菌根菌の種多様性は、降雨から7日で有意な増加が見られた。
2. 津波による被害を受けた東北地方の海岸クロマツ林の現地調査を行った。この結果、海岸林では土壌中のナトリウムの増加、およびpHの上昇が確認された。このナトリウム、およびpHに耐性の高い菌根菌種の選抜を行ったところ、これらに高い耐性を持つ2種類の菌根菌が得られた。



Coastal pine forest destroyed by Tsunami

Takeshi Taniguchi (Assist. Prof., Microbial Ecology)

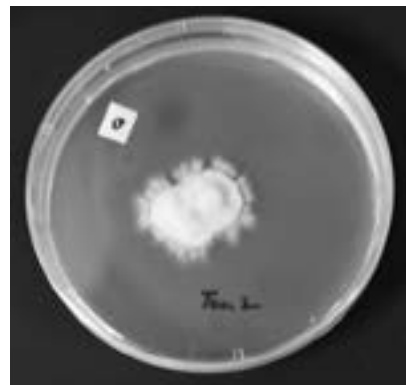
Microorganisms are micro-level and very small organisms, but their biomass and function on earth are extremely large and strongly affects the carbon and nitrogen cycle on the globe. Some microorganisms are also very important for ecosystem restoration in arid regions because they have roles for the enhancement of the establishment of plants, improvement of their stress tolerance, and the stabilization of soil. My laboratory mainly studies about the ecosystem restoration with microorganisms. In addition, my laboratory focuses on the various scales of phenomenon and problems in arid region, ranging from micro- to macro-scales, and aims to reveal or solve them via microorganisms such as bacteria and fungi. Followings are the topics of my laboratory:

- Plant-microorganism symbiotic relationship under stressful conditions and the application to ecosystem restoration,
- Exploration of useful micro organic composition for plants under stressful conditions,
- Formation of soil aggregates by mycorrhizal fungi in the source region of Asian dust,
- Relationship between microbial biomass and soil respiration in arid regions.

These researches are collaboratively conducted with overseas research institutes mainly in the United States, China, and Mongolia.

In fiscal year 2012, I obtained results from following researches:

1. Effect of summer rain on the biomass and community structure of ectomycorrhizas was examined in a semi-arid region in California, U.S. Biomass of ectomycorrhizas gradually increased and reached 1.5-2 times after 7 days from rain. Species diversity of ectomycorrhizal fungi was significantly higher than that of before rain.
2. Field survey was conducted in coastal pine forest in Tohoku region destroyed by Tsunami. In the forest, sodium concentration and pH in soil were higher than those in undamaged pine forest. Sodium and pH tolerant mycorrhizal species was also explored and two ectomycorrhizal fungal species with high tolerance to sodium and pH were found.



Ectomycorrhizal fungal species with high salt and pH tolerances

井上 光弘 (土地保全学)

乾燥地における土壌劣化 (土壌侵食、塩類集積) の軽減と、持続的農業のための適切な土壌・水管理の開発を中心的な研究課題としている。特に乾燥地の砂漠化防止のための土地保全に関する技術開発に力を入れている。

最近の主な共同研究の課題は、

- 誘電率水分計の塩依存性の検討
- 塩水灌漑下の作物生産に及ぼす土壌改良材の効果
- 地中灌漑による野菜節水栽培
- ひも灌水システムを用いた砂ベッド栽培
- リサイクル資材を用いた省力型節水灌漑法の開発
- 乾燥地の土壌物理特性の決定
- 海岸地下水を用いたトマト栽培 (図参照)
- 集水のためのキャピラリーバリアの役割
- 冬季の温泉水利用による土壌環境改善 (図参照)



Tomato grown in a greenhouse using coastal groundwater transported by natural energy (Sweet is sugar content of 10 brix)

Mitsuhiro Inoue (Specially Appointed Prof., Land Conservation)

My central challenges are research on the reduction of soil degradation (soil erosion and salt accumulation), and on developing optimal soil and water management for sustainable agriculture in arid region. Particular efforts are being made to develop a proper technology for the land conservation to prevent soil degradation. Following are recent research topics supported by the joint research program:

- Evaluation of salinity dependence effect on measurement of soil water content using dielectric moisture sensor,
- Effect of soil amendments on crop production under saline water irrigation,
- Water-saving vegetable cultivation using subsurface irrigation,
- Sand bed cultivation using wick irrigation system,
- Development of labor-saving and water-saving irrigation using recycled products,
- Determination of soil physical properties in arid regions,
- Tomato cultivation using coastal groundwater, (Fig)
- Role of capillary barrier for water harvesting,
- Improvement of soil environment using hot spring water in winter season. (Fig)



Comparison of vegetable growth in sand bed between using heated water (simulated hot spring water) and unheated water in greenhouse in water.

4) 社会経済部門

安藤 孝之 (乾燥地開発学)

乾燥地開発学分野では、乾燥地の人々の生活と環境の相互作用の評価及び乾燥地開発プロジェクトの形成・運営管理・評価の一環として、バイオ燃料植物を用いた乾燥地における持続的農村開発システムに関する研究を行っている。バイオ燃料植物としては乾燥に強く、作物栽培に適さないような土地でも栽培が可能であり、貧しい農村の貧困削減や生活の向上に活用できると考えられるジャトロファ (ナンヨウアブラギリ、*Jatropha curcas* L.) を対象に検討を行っている。2012年度においては主として以下の活動及び成果を得た。

(1) 効率的なジャトロファ栽培の普及方法の解明

効率的なジャトロファ栽培の普及方法を明らかにするため、メキシコ合衆国南部チアパス州内のジャトロファ栽培農家を対象として、特にジャトロファ栽培が放棄された原因、ジャトロファ栽培の普及を阻害する要因に関する調査を行った。

その結果、ジャトロファ栽培が放棄された原因には、ジャトロファ栽培への栽培奨励金 (ProArbol) の給付が受けられなかったこと、ホリネズミ (現地名 tuza) によるジャトロファの根への食害の2つが存在することが判明した。また、ジャトロファ栽培上の課題として、種々の病虫害の発生及び農民からの信頼度の低い普及員の存在が指摘された。ジャトロファ栽培の普及を阻害する主な要因には、販売による収入が得られるまでの経済的負担と害虫 (獣) 害等の栽培上の課題があることが示された。

今後の栽培・普及の改善には、栽培奨励金の確実な給付、ジャトロファ栽培に関する市場の情報及び普及用資料の提供、普及員によるきめ細やかな栽培技術指導、特に害虫 (獣) 害防除対策、適正な利益を得ることのできる種子販売価格の設定が重要であることが明らかとなった。

(2) コアコレクション構築プロジェクト

2010年7月に開始されたメキシコ国立農牧林業研究所 (INIFAP) との共同研究プロジェクトであるコアコレクション構築プロジェクト (正式名称: バイオ燃料生産及び乾燥地あるいは荒廃地の再植林に適した品種開発の基礎となる *Jatropha curcas* L. のコアコレクション構築) に関して、9月3日に進捗状況の確認及び今後の研究計画の協議のために INIFAP を訪問し協議を行った。



Tuza, an animal which damages to jatropha roots (photo by Ms. Reina G. Trujillo)

4) Socioeconomics Division

Takayuki Ando (Assoc. Prof., Arid Land Development)

The arid land development subdivision conducts studies on the sustainable rural development system in arid land using biofuel plants, to assess interrelation between livelihood and environment and use results for better formulation, operation and evaluation of arid land development projects. *Jatropha curcas* L. has been focused on principally as a biofuel feedstock because this plant is drought-resistant.

Main activities in the fiscal year 2012 were as follows.

(1) Identification of efficient *Jatropha* extension system:

I conducted surveys with jatropha growers in the Chiapas State of Mexico to understand why jatropha cultivation was abandoned and the challenges associated with jatropha cultivation. The reasons identified for abandoning jatropha cultivation include non-receipt of the financial incentives and outbreaks of pests and diseases, specifically damages by gophers (tuza as the local name) to jatropha roots. The major challenges were the control of various pests and diseases and the lack of technical assistance from extension workers. Therefore, the conditions needed for the establishment of jatropha cultivation are attentive technical support from extension workers, especially on pest and disease control, and technical guidance on jatropha cultivation. To further encourage jatropha cultivation, there must be reliable payment of financial incentives for jatropha cultivation, as well as the sharing of cultivation and marketing information. Extension workers should provide attentive technical assistance, especially on pest and disease control. Finally, it is crucial to determine the selling price of jatropha seeds that provide farmers with an appropriate income to achieve stable cultivation.

(2) The *Jatropha* Core collection project:

The project started on July 2010 with INIFAP (National Institute for Investigation in Forestry, Agriculture and Animal Production of Ministry of Agriculture, Animal Production, Rural development, Fishery and Alimentation, Mexico) and ALRC. We visited INIFAP on Sept. 3 to discuss on the progress of the project and the research plan.



Meeting with INIFAP researchers on the joint research on *Jatropha*.

鍋田 肇 (国際開発協力学)

乾燥地の農業は様々な課題に直面している。作物や家畜生産に利用できる水資源は不足し、それから来る土地劣化の問題も深刻で、結果として社会経済的な不安定がもたらされる。国内に乾燥地を抱える国々は土地と水資源の過剰な利用に起因する様々な負の影響に対処しつつも国民の生計を支える必要があり奮闘中である。政府の対応には国際協力が不可欠であり、中でも生産者の支援につながるような人材育成の協力は重要である。

このような中、アフリカや中近東の約30か国の政府は、鳥取大学やJICAと協力して過去25年に互り乾燥地農業に関する技術研修ワークショップを実施し、土地劣化の評価や塩類化対策、総合的な水資源管理等の分野で人材育成を行っている。しかし限られた人数の技術者を育てても一国のニーズを満たすには不十分なうえ、外国機関の経験がそのまま乾燥地を持つ国々の多様な状況に使える訳ではない。

これらを念頭に、政府・鳥取大学・JICAの三者協力の経験を材料とし、技術協力を成功に導き更に広げて行ける要因や課題を明らかにする目的で研究している。

技術研修ワークショップの参加者達は、最後にアクションプランを作成するので、そこでの行動計画と彼らの帰国後の計画進展を比較し、上手く行く場合の要因等を分析している。過去25年間に参加した約230名の参加者のうちeメールでコミュニケーション可能な約80名を対象に調査したが、帰国後、一人で研修成果を現場に広めるのは困難で、実施中事業や他の元参加者とのリンクを上手く作れた元参加者が実績を挙げている状況が見えてきた(図)。

他の調査では、乾燥地コミュニティで家畜が果たす役割の重要性に着目し、このようなコミュニティの農牧システムによる生計向上を妨げる政策課題を明らかにすべく研究する。平成24年度はスーダン東部のカッサラ州で政府が行う住民支援プロジェクトの住民にインタビューする機会を得た(図)。州政府は、獣医サービスを強化していると説明するが、住民インタビューでは政府支援はないとの不満が聞かれ、引き続き研究を進める必要がある。



An ex-Participant of Tottori training workshop shares gained experiences with farmers in Ethiopia, thanks to a functioning initiative in place for outreach.

Hajime Nabeta (Assoc. Prof., International Development Cooperation)

Dry land agriculture faces multi-faceted challenges including scarce water resources for crop and livestock, accompanying risks of land degradation, and resultant socio-economic instabilities. The governments of countries with sizable dry lands are struggling to cope with adverse effects of exploitative land and water use while supporting people's livelihood. International cooperation plays an important part in this, and human resource development and institutional capacity development to assist producers are among the most important.

In this context, some thirty, largely African and middle-eastern, countries have been working with Tottori university and JICA to train their human resources in dry-land agriculture technologies for the last 25 years with training workshops in Tottori on land degradation evaluation, desalinization, comprehensive water management, etc. However, training limited numbers of technical personnel would not easily meet requirements of a country and not all the international development agency's experiences are readily applicable to the realities of diverse country situations.

With this in mind, I am studying experiences of this tripartite capacity development collaboration to identify successful features and challenges for technical cooperation. By analyzing Action Plans participants produce at the end of the workshop and the progress later reported from their countries, it is being suggested that ex-Participants who win access to an on-going similar efforts have more chances to disseminate acquired knowledge (Fig.).

In a separate activity, considering important roles played by livestock in rural communities of dry-land countries, I have been working to identify key policy constraints related to the agro-pastoral production system that hinder livelihood improvement of such communities. For this, field visits were made in FY 2012 to Sudan where I had an opportunity to interview local residents in Kassala State through a government assisted project (Fig.). Despite the local government's efforts to provide improved veterinary services, the residents were not in appreciation of it. Obviously more research works are required in FY 2013.



Rural residents of Kassala State of Sudan derive much of the livelihoods from livestock and sorghum, but sending out their sons to towns for income opportunities is as important.

(3) テニュアトラック教員

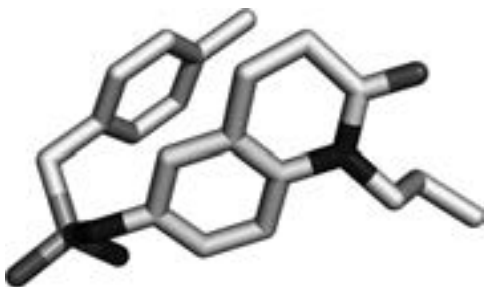
岡本 昌憲 (植物分子生物学)

陸上植物は動物と異なり、いったん発芽してしまうと、環境が悪化しても違う場所へ移動することができない。そのため、植物には様々な環境ストレス（乾燥、高塩、高温、低温ストレスなど）に対する防御システムを備えている。当研究室では、モデル植物であるシロイヌナズナや重要作物であるコムギ等を用いて、ストレス耐性の分子機構を様々な実験手法を駆使して解明することを目標としている。得られた知見を乾燥地における栽培作物に応用し、作物のストレス耐性向上に結び付けられるように多角的なアプローチをとって研究を進めている。現在、以下に示す研究を進めている。

- 乾燥ストレス耐性を向上させる化合物の探索とその応用
- 選択的 ABA アゴニストを用いた化学遺伝学的手法による ABA 受容体の機能解析
- 選択的アブシジン酸 (ABA) アゴニストを用いた新奇 ABA シグナル因子の探索
- ストレス環境下における mRNA 代謝制御の分子生理学的解析
- ストレス環境下におけるアントシアニン・フラボノイド生合成制御因子の分子生理学的解析
- 遺伝子として未登録の領域に存在するスモールペプチド (sORF) の機能解析
- ABA 受容体を利用した乾燥耐性作物の創出
- 合成コムギ系統からの乾燥・高塩ストレス耐性系統の選抜と分子生理学的解析

これらの研究は、カリフォルニア大学リバーサイド校、トロント大学、理研、九州工業大学、静岡大学などの研究機関と共同で研究を行っている。本年度は以下に示す成果を得た。

1. ケミカルスクリーニングによって新奇の ABA アゴニストを複数発見した。
2. 遺伝子として存在が報告されていないゲノム領域に大量の sORF が存在し、様々な sORF が植物の形態形成に関わっていることを世界で初めて明らかにした。



Novel ABA agonist (quinabactin) is able to elicit ABA action in plants.

(3) Tenure-Track

Masanori Okamoto (Assist. Prof., Plant Molecular Biology)

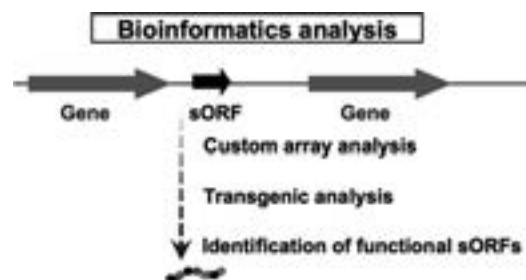
Unlike animals, higher plants are not able to move to other places after germination. Therefore, plants have complex defense systems for various environmental stresses (cold, drought, heat and high salt stresses). In our laboratory, main goal of the research is to elucidate molecular mechanism for stress responses using Arabidopsis or wheat as plant materials. Additionally, our task is to apply obtained knowledge to cultivated crops in semi-arid land region in order to develop stress tolerant crops. We are conducting research with multiple approaches using molecular biology, biochemistry, genetics and physiology. The following are current main researches in our laboratory.

- Screening and application of agrochemicals that control drought stress tolerance
- Functional analysis of abscisic acid (ABA) receptors by selective ABA agonist
- Identification of novel ABA signaling mutants by chemical genetic screening
- Molecular and physiological analysis of mRNA metabolic proteins in response to heat stress
- Molecular and physiological analysis of key factor for anthocyanin biosynthesis under the drought stress
- Functional analysis of small open reading frames (sORFs; 30–100 amino acids), which exist in the intergenic region
- Generation of drought tolerant wheat by using ABA receptor.

These researches are being conducted with University of California Riverside, Toronto University, RIKEN, Kyushu Institute of Technology and Shizuoka University.

The following are highlights in the fiscal year 2012.

1. We identified novel ABA agonists by high-throughput chemical screening. These ABA agonists induced ABA action in plants.
2. More than 2000 sORFs were expressed in the intergenic region of Arabidopsis genome. A total of 473 sORFs were overexpressed, and ~10% sORFs among them induced visible phenotypic effects, suggesting that sORFs have biological function in plants.



Functional sORFs were identified by integration of bioinformatics, custom array and transgenic analyses.

(4) 外国人客員研究員 / Visiting International Researchers

Ali, Abdelbagi Mukhtar (Prof., Molecular Breeding)

October 2011–May 2012

Title: Basic research on breeding of stress-tolerant wheat by genetic engineering

My research focuses on breeding of stress-tolerant wheat by genetic engineering. Wheat belongs to Triticeae tribe which has more than 300 species that inhabit harsh environments in cold, humid, saline or dry regions, where wheat cannot survive. These species are crossable with wheat; however, most of it has never been used in wheat improvement. Very useful synthetic materials have been developed by crossing wheat with wild relatives. Useful traits from these materials have been reported such as unique seed storage proteins, nitrogen or phosphorus use efficiencies. Transferring these genetic resources into Farmer Preferred wheat varieties will pave the way for more food and better sustainable agricultural production in arid regions. In this context, following experiments were conducted:

a. Mapping of useful adaptation genes for hot dry environment in 112 wheat-alien recombinant inbred lines (RILs) that are developed from a cross between wheat and a synthetic hexaploid (*T. carthlicum stramineum* X *Ae. Taushii*). These RILs were evaluated in the Gezira Research Station, Wad Medani, Sudan, and the results showed significant variability with some lines performed similar or better than local checks. DNA from these RILs was used to develop DArt molecular markers. Phenotypic and molecular data are under processing, and a comprehensive genetic map for adaption genes for hot dry environment is expected to be generated and published.



Wheat lines grown in the research field in Sudan.

b. Development of multiple synthetic derivatives (MSD) populations in the genetic background of farmers preferred wheat varieties for hot dry environments. Crosses between 47 wheat synthetic lines and 5 Sudanese wheat varieties are grown in the field. F1 seeds will constitute the base for development MSD in the background of variety Tagana. The developed MSD will be evaluated and deployed in stressed environment. The process will be accelerated with molecular marker and doubled haploid technologies.

c. Evaluation of Genotype by Environment interaction for heat bread making quality under hot dry Environment. Twenty-four wheat genotypes were evaluated across four locations in Sudan that are distributed along temperature gradient ranging from very hot, hot, intermediate and cool temperature from central to northern Sudan. Grain samples were brought to bread making quality analysis in Japan. The outcome of this experiment will be useful for improving the quality of wheat varieties under hot dry environment.

d. Others contributions and activities during my research visit included the participation on academic seminars and strengthening the collaboration between my research institute and the ALRC.



Wheat lines grown at different sowing dates for heat stress evaluation in the research field in in Sudan.

Andry Henintsoa Ravolonantenaina (Assoc. Prof., Soil and Water Conservation)

April 2012–March 2013

Title: Management of Nutrients and Sediment Losses from Arid Land Subtropical Acid Soil Environment

I worked on soil and water conservation in arid and subtropical climate during the one year visiting research at the Arid Land Research Center, Tottori University. Tests of the effects of two different materials derived from organic waste materials on both sandy and natural acid loam soils'hydraulic properties, organic carbon contents, nitrogen leaching, water soluble aluminum, and plant growth under greenhouse condition were conducted during the summer of 2012. And from autumn to this winter, test of the effect of cow manure biochar on wheat growth under acid soil has been conducted in a 1/2000 pot experiment under greenhouse condition.

Experiment No. 1:

An Evaluation of the Beneficial Effect of Carboxymethyl-celluloses (CMCs) Inter-linked by Radiation on Sandy Soil Properties and Tomato Development

The objective of the present study was to determine the longevity effects of CMCs, mixed at various rates with a sandy soil, based on the results of the 2011 and 2012 studies, on the soil water-holding capacity and hydraulic conductivity, and on tomato yield irrigated with saline water under greenhouse conditions. Results showed that total carbon and nitrogen in the soil after 2011 corn experiment increased significantly ($p < 0.001$) with CMCs mixing ratio under the two water irrigation qualities, in general. It was found that CMC with large grain size was most effective than the small one. There was also no significance difference effect among the water qualities treatments. A decrease in total carbon and nitrogen was found in the soil after 2012 experiment as compared to that in 2011. Overall, the soil saturated hydraulic conductivity (KS) decreased with increasing the CMCs mixing rate. The effect of CMCs grain size on KS is significantly

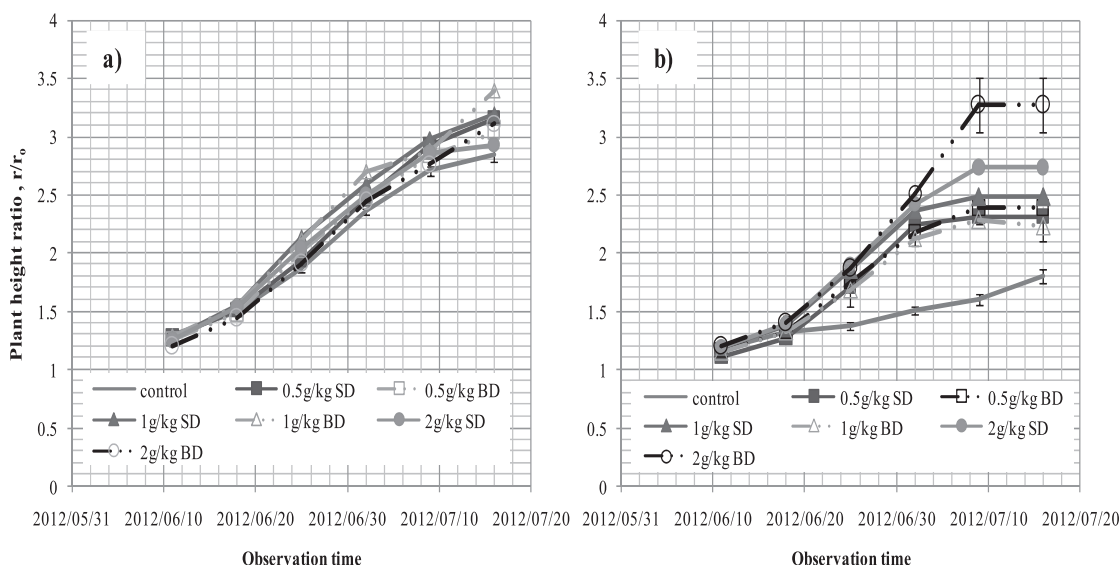
cantly apparent ($p < 0.001$) particularly under saline irrigation. The plant water availability soil moisture (PWASM) was consistent with the soil KS, showing a relative decrease after 2012 experiment. After 2011 experiment, all treatments were significantly efficient in increasing the PWASM than the control soil; however, its significance decreased as the polymer concentration decreased after 2012. This result could be attributed to the CMC water solubility characteristic. The one year longevity effect of the CMCs on water absorption as result of the fresh water and 4 dS/m saline water was relatively the same. There is no difference among the treatments on plant development under fresh water. The beneficial effect of CMCs, which was the result of the soil nutrients retention and hydraulic properties improvement, was only significantly apparent ($p < 0.001$) under saline water irrigation.

Experiment No. 2

Effect of Cow manure Biochar and its Feedstock Source on Maize Growth under Acid Soil Condition

The main objective of the research was to determine the effectiveness of cow manure biochar and its feedstock source on some acid soil physic-chemical properties and that impact on plant production grown under this condition.

It has been found that cow manure was more effective in improving soil physical properties than boichar, where as the latter was in soil chemical properties. The greater increase in plant growth has been attributed to the significant improve in soil aggregate structure, increase in soil pH, CEC and nutrients availability, as well as decrease in aluminum toxicity in the soil. However, additional field studies on the long term effect of organic waste materials on soil physico-chemical properties and plant productivity are needed to understand the sustainability of these wastes as a soil amendment. Using organic waste material as a soil amendment could improve not only the soil and water conservation by increasing the soil resistance to water erosion and plant productivity but can also address the issue of industrial waste matter disposal.



The plant development expressed as plant height ratio in function of CMCs mixing rate. a) irrigated with fresh water, b) irrigated with saline water (4 dS/m)

Mohamed Ahmed, Mohamed Abd Elbasit (Junior Assoc. Prof., Hydrology)

April 2012–March 2013

Title: Spatial modeling of soil crust formation factors and their impact on water distribution under arid and semiarid environments

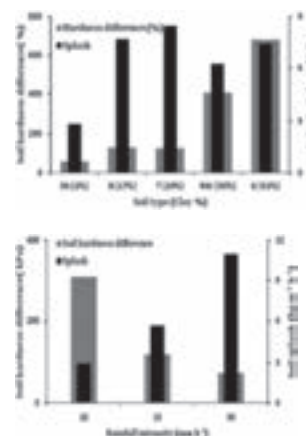
The process of soil water erosion starts by the impact of raindrop on unprotected soil surface causing sediment detachment, and soil consolidation. The small soil particles may precipitate to the lower soil surface leading to hard and semi-impermeable layer generation. The process that generates a thin layer of soil that has low permeability and high cohesion is called soil crust formation. The crust is a type of land degradation that can interfere with all causes of land degradation including the deterioration of ground water recharge, i.e. by reducing the amount of water that can be infiltrated to recharge the ground water. The recognition of crust affected areas and susceptible areas for soil crust represent a challenge for mapping the land degradation. Our research was focused on the determination of soil crust formation under simulated rainfall using five soil samples and three rainfall intensities. The five soil types range from sandy soil (sand dune) to clay loam soil. Four soil samples were collected from Tottori prefecture and one collected from Al-Rawakeeb Research Station, Desertification Research Institute, NCR, Sudan. The rainfall micro-properties (Drop size distribution, and kinetic energy) were measured using piezoelectric transducer. The crust formation was evaluated by monitoring the changes in soil hardness, and infiltration compare to soil reflectance and micro-morphology. The soil micro-morphology was measured using computed tomography scanner.

Experiment 1: Characterization of simulated rainfall using piezoelectric transducers

The rainfall simulator was found to have rainfall properties similar to natural rainfall until 30 mm h^{-1} . The relationships between the pump flow rate (L h^{-1}), drop size distribution (DSD), median drop size (D_{50}), and Kinetic energy ($\text{J m}^{-2} \text{ mm}^{-1}$) from one side and rainfall intensity from other side were determined. The relationships is basic rainfall simulator information that can be used to compare the simulated and natural rainfall. However, the performance stability of the simulator must be considered.

Experiment 2: Soil crust formation and splash erosion due to raindrop impact

The changes in the soil hardness showed high association with the soil types specifically the clay content percentage. The changes in average infiltration was not significant, which suggests that the total rainfall impact energy was not enough to cause significant changes in the soil porosity except for the high clay content soils. The soil type and the rainfall intensities were found to have significant impact on splash ($P < 0.05$). on the other hand, the changes in hardness was significantly affect by the soil type (specifically clay content).



Impact of soil type and rainfall intensity on soil splash erosion and soil hardness differences under simulated rainfall



X-Ray CT scanning, Spectro-radiometer, Infiltration and Hardness

Tsegaye, Enyew Adgo (Assoc. Prof., Soil Science)

October 1, 2012–March 2013

Title: Soil and water conservation in farmland Ethiopia

Ethiopia faces serious degradation of land and water resources. Soil erosion by water, the major forms of land degradation, challenges millions of subsistence farmers and hampered food production, ecosystem integrity and thus aggravates the extent of poverty in the country. Estimated rates of soil erosion from cultivated lands can reach up to 300 tonnes per ha which is more than 40 times of the rate of soil formation. Poor land management, high population and livestock pressure and subsequent cultivation of marginal lands and overgrazing are major drivers of soil erosion. At the same time, efforts are being done to curb the problem by mobilizing millions of farmers every year to conserve land and water through different soil water conservation (SWC) measures. Achievements of such massive efforts are mixed. Sustainability of the land management activities through mass mobilization are concern of many scholars and always a debate of scientific fora. Improving scientific understanding of land and water resources including socioeconomic realities thus helps to effectively manage the resources. My research at ALRC is assumed to contribute to this broad development goals.

The main specific tasks during the period include:

- Publication of scientific papers including follow up, analyse, write up and /or finalization of papers dealing with different aspects of land and water management aspects,
- Initiating a joint research project that could be implemented in Ethiopia in collaboration with Bahir Dar University
- Involving in research undertakings which was not specified during the early months of the reporting period and
- Participating in Plant Production Division and ALRC seminars and including in monthly regular meetings of the Division of Plant Production.

Details of the above activities are described below:

- Developing a joint project

With staff members of the Plant Production Division, we managed to develop and submit a joint project between Tottori and Bahir Dar Universities. The project entitled 'Developing multi-criteria decision support system for sustainable management of land and water allocation in the Upper Blue Nile basin' aims at quantifying impacts of sustainable land management initiatives of Ethiopia on land resource conservation and productivity and ecosystems functions in Ethiopia. Investigating effects of such interventions on downstream users such as Sudan and Egypt and help to understand cross boarder impacts of such interventions. The project has been submitted to the Japanese Society for the Promotion of Science.

- Undertaking research activities

Investigating the chemical and physical properties of selected soil in Ethiopia has been identified as important research topic during the period. Many properties of Ethiopian soils such as clay mineralogy, humus types, micro nutrient

status, water retention properties and others are not well know. Understanding such properties will help to manage the soil resources. Therefore, it is planned to bring soil samples from Ethiopia and investigate at labs of ALRC and Tottori University, Faculty of Agriculture. Accordingly, a research protocol has been developed, import permit to Japan processed, and sampling materials purchased and a business trip is planned as of 31 st of March, 2013. A total of 15 kg soil samples from representative areas will be brought and investigated.

- Participating in Plant Production Division, ALRC seminars

Besides attending seminars given by visiting researchers of ALRC and staffs of Plant Production Division as well as seminars of other visitors, I have given two presentations; one for the Division and the other for the ALRC on the following topics related to my research experiences:

- Fighting Soil Erosion in Ethiopia: An Issue for Decades to Come, Plant Production Seminar January 16, 2013
- Effects of SWC on land productivity and farmer's income: A case study in Ethiopia, Presented on Open Seminar of ALRC, March 6, 2013, Tottori

(5) プロジェクト研究員

留森 寿士 (乾燥地植物資源バンク室)

乾燥地は、生産性が低いため貧困度が高く、さらに生態系も脆弱なため、過放牧や過伐採、過耕作などの人為的要因により砂漠化が進んでいる。これら乾燥地が抱える問題に対処するため、地域住民の従前の農業形態や生活様式を極力変えない、環境保全と貧困削減を同時に達成する新しい栽培・緑化手法を開発することを目指している。このため、①植物資源の有効活用、②環境耐性を持つ品種・系統の開発、③乾燥地に適した栽培・緑化手法の開発を行っている。

バイオ燃料生産は日常生活に必要なエネルギーの確保のみならず、慢性的な貧困を抱える乾燥地の農村社会における収入の向上による貧困削減の手段として期待され、導入が促進されている。さらに、植物由来の原料を燃焼して排出される二酸化炭素は、植物が大気中から吸収したものであるため、二酸化炭素の排出量はゼロと考えられ、地球温暖化防止の対策として、石油に替わる非枯渇性資源として注目されている。しかし、乾燥地における植物によるバイオ燃料生産は、順調に進んでいるとは言えない。そこで、乾燥地での栽培が期待される油料植物であるジャトロファの生産向上に資する研究を進めている。

本年度は、以下の研究に注力した。

- ジャトロファの原産地であるメキシコ合衆国チアパス州において、メキシコ国立農牧林業研究所 (INIFAP) と共同で、耐寒性および耐塩性の系統を探索し、採取した。採取したジャトロファは日本に持ち帰り、環境耐性の評価を行うために増殖している。
- ジャトロファにおける施肥方法と成育の関係を調べた。
- 大阪大学 (福井教授ら) と共同で形質転換したジャトロファの耐乾性を評価し、乾燥条件下からの復活期に野生系統との違いがあることを見出した。
- 神戸大学 (近江戸教授ら) と共同で、ジャトロファの早期開花組換え体創出に関する研究を行い、ジャトロファの開花に関する知見を得た。
- 塩水利用可能な養液栽培装置の改良を行い、野菜等の草本類だけでなく果樹等の樹木でも利用可能な栽培装置の開発を行っている。



Investigation of cold-tolerant jatropha in Mexico

(5) Project Researchers

Hisashi Tomemori (Laboratory of Arid Land Plant Resources)

Owing to the low land productivity, drylands have high poverty rates. Furthermore, because their ecosystems are fragile, desertification is proceeding due to anthropogenic factors including overgrazing, excessive logging, and over-cultivation. To deal with the problems faced by drylands, we aim to develop new cultivation and greening techniques that achieve both environmental conservation and poverty reduction with minimal changes to the inhabitants' customary forms of agriculture and ways of life. For this purpose, we are developing: (1) ways to effectively use plant resources; (2) crop varieties and strains with environmental tolerance; and (3) cultivation and greening methods suited to drylands.

Biofuel production is being encouraged because it offers hope not only for securing the energy needed for daily living, but also for providing a means of reducing poverty by raising incomes in dryland rural societies, which suffer from chronic poverty. And yet, it would be hard to say that biofuel production from plants in drylands is proceeding smoothly. For this reason, we are conducting research that will help improve the production of jatropha, a drought-tolerant oil plant with prospects for dryland cultivation. For the fiscal year 2012, we concentrated on the following research.

- In Mexico's Chiapas State, which is where jatropha originates, we searched for and collected cold- and salt-tolerant strains in collaboration with the National Institute of Forestry, Agriculture, and Livestock Research (INIFAP). We brought the collected jatropha back to Japan, and are now propagating it to assess its environmental tolerance.
- We investigated the relationship between how jatropha is fertilized and how well it grows.
- In collaboration with Prof. Fukui and others at Osaka University, we assessed the drought tolerance of transformed jatropha, and found differences from wild strains in how long it takes to revive under dry conditions.
- In collaboration with Prof. Ohmido and others at Kobe University, we conducted research on the creation of early-flowering recombinant jatropha, and obtained findings on jatropha flowering.
- We improved a nutriculture system that can use saline water, and are developing a cultivation system that can be used for not only vegetables and other herbs, but also trees such as those that bear fruit.



Flower bud of jatropha

井上 知恵 (乾燥地植物資源バンク室)

ジャトロファ (*Jatropha curcas*) は、種子に30%以上の油が含まれる。バイオ燃料植物として近年アフリカや中央・南アメリカ、インド、東南アジアで栽培が拡大している非常に有望な植物資源である。ジャトロファの原産地であるメキシコにある国立農牧林業研究所 (INIFAP) では、多様なジャトロファの遺伝子源を収集・保有・管理している。バイオ燃料としてのジャトロファのさらなる生産性向上のためには、農業特性を制御している遺伝子の探査およびそれらを利用した品種改良が必須である。本年度は、INIFAPで保有しているジャトロファ系統を用いてアソシエーション解析を行い、種子生産に関わる諸形質に関連するマーカーを調べた。花、果実および種子に関する10形質について、有意な相関を示すマーカーをいくつか同定することができた。一般に花序に関わる遺伝子は少ないことから、これらのマーカーの近傍に機能遺伝子があると考えられた。6つの形質(花房当たりの果実数、果実重、種子重、種子の長さ、個体当たりの果実数、個体当たりの果実重)については、関連するマーカーがなかった。また、花、実および種子のいずれにおいても高い相関および寄与率を示す3つのマーカーを同定できた。

根寄生植物ストライガ (*Striga hermonthica*) は、ソルガムやパールミレットなどのイネ科の主要作物に寄生することから、アフリカの乾燥地で主要作物の収量低下の最も大きな生物学的要因となっている。これまで、ストライガと宿主の光合成特性や気孔応答について、スーダン科学技術大学の研究者らと共同研究を行ってきた。土壤乾燥条件下でストライガの被害が深刻であることから、本年度は、異なる土壤水分条件下でのストライガと宿主のソルガムの気孔応答および気孔応答に対する内生および外生アブシジン酸 (ABA) の影響を調査した。ストライガはソルガムに比べて、土壤乾燥およびABA葉面散布処理に対して気孔開度、気孔コンダクタンス、蒸散速度の低下が小さいことが分かった。また、ストライガは出芽前からソルガムに比べて内生ABA濃度が約10倍高いことが分かった。

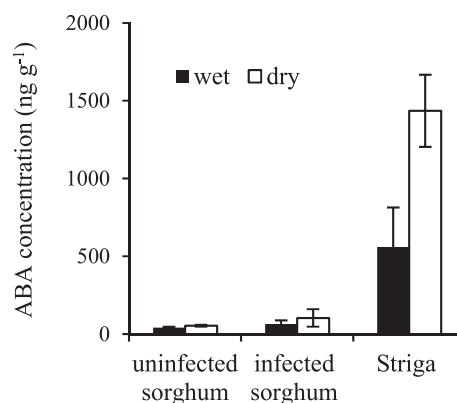


Inflorescence of *Jatropha curcas*.

Tomoe Inoue (Laboratory of Arid Land Plant Resources)

Jatropha curcas, originated in Mexico, is a promising source of bioenergy, and currently widely cultivated in Africa, Central and South America, India and Southeast Asia. The seeds of *J. curcas* contain more than 30% oil. INIFAP, Mexico, has collected various *J. curcas* accessions from different regions in Mexico. To improve seed oil production in *J. curcas* by breeding, identification of genes regulating agronomic traits is essential. In the fiscal 2012, molecular markers associated with inflorescence, fruit and seed traits in *J. curcas* were investigated using the INIFAP accessions. We found several markers associated with 10 traits. Among those markers, three markers showed high association and contribution to all inflorescence, fruit and seed traits. In general, a few genes regulate inflorescence, which suggests that functional genes are located near those markers. There was no marker associated with 6 traits (no. of fruit per cluster, fruit weight, seed weight, seed length, no. of fruits harvested per plant, fruit weight per plant).

Root hemi-parasite *Striga hermonthica* parasitizes gramineous plants, including sorghum and pearl millet, so that it is the most serious biotic constraint on crop production in the dry areas of Africa. I have conducted joint research on photosynthetic capacity and stomatal responses in *S. hermonthica* and host sorghum with the researchers at the Sudan University of Science and Technology. In fiscal year 2012, as *S. hermonthica* damage on crops is more serious under drought, effects of soil water stress and endo/exogenous abscisic acid (ABA) on stomatal closure in *S. hermonthica* and its sorghum host were investigated. Under soil water stress and foliar application of ABA, reduction in stomatal aperture, stomatal conductance and transpiration rate in *S. hermonthica* was lower than in sorghum. Even before *S. hermonthica* emergence from the soil, endogenous ABA concentration in *S. hermonthica* was about 10 times higher than in sorghum.



Abscisic acid concentration in sorghum and *Striga hermonthica*.

李 衡峻 (水環境科学)

1. 乾燥地での降雨量時系列

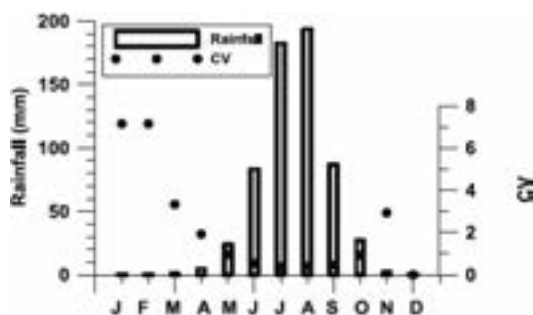
乾燥地では降雨量の変動が激しく、住民の生産活動と生活に大きな影響を与えている。平均降雨量と変動係数は逆比例の関係にあるため、少雨に加えて変動が大きく、水資源管理がより困難である。降雨の変動は農業生産のみならず、野生動物の生態系にも大きな影響を及ぼしている。ナイル川中流域スーダンの農業地域であるガダーリフにおける1960～2011年のデータを用いて降雨時系列の変動を分析した。本年度は以下のような結果をまとめた。

- 7～8月を含め夏季に降雨が集中して、11～3月には降雨が非常に少ない。また、降雨変動係数は夏季に低く、冬季に高い。
- 正規化年降雨量時系列には豊水と渇水の傾向に連続性がみられる。
- 降雨から2か月後に正規化植生指数 (NDVI) が高くなる相関が結果から降雨変動と植生生態系に高い相関がある。

2. 水田からの汚濁負荷

農耕地は水質汚染問題の重要ソースであり、特に水田では水使用量と施肥量が多い。灌漑期中にも様々な農作業があり、農業活動によって流出特性が異なることが予想される。水田流域からの汚濁負荷流出特性を調べるため、4年間調査を行った。明らかになった結果を以下に示す。

- 代掻き田植え期と中干し期に汚濁物質の濃度と負荷量が多かった。
- 間断灌漑期には窒素の正味負荷がマイナスであった。
- 水田流域での汚濁流出特性は農業活動に影響を受けるため、原単位は農業イベントに合わせて区分しなければならない。



Mean monthly rainfall and coefficient of variance

LEE Hyungjun (Water Environment Science)

1. Rainfall Time Series of Arid Area

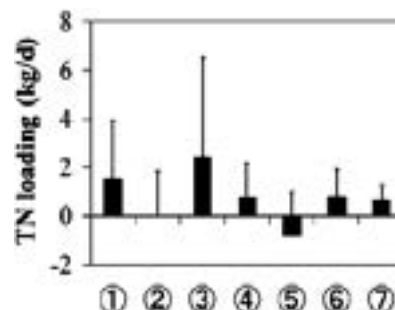
In the arid area, rainfall varied widely, and it affects agricultural activities and human life. Because the average rainfall is in inverse proportion to Coefficient of Variance, CV differs to small rainfall. It means it is hard to control the water resource which is limited. Rainfall variation affects not only agricultural activities but also ecology. We researched the rainfall time series of Gadaref in the midstream of Nile basin using rainfall data between 1960 and 2011. In this fiscal year, I obtained following results.

- Rainfall was concentrated in summer season especially July and august, otherwise, there is very less rainfall in winter season. And CV
- From the trend of standardized rainfall, it appeared abundance water period and shortage water period continuously.
- Normalized Difference Vegetation Index and rainfall shows good correlation and NDVI get increased from the rainfall.

2. Pollutant load from a paddy field

Agricultural land is major sources to water quality problem, and especially there is much use agricultural water and fertilizer in the paddy field. There are various agricultural activities during irrigation period, we expect pollutants runoff characteristic will differ by agricultural activities. We investigated the pollutants runoff characteristic of paddy field watershed during 4 years. In this fiscal year, I obtained following results.

- Pollutant concentration and load was high in puddling and rice-plant period. And it increased during the mid-summer drainage period again.
- Net loading of Total nitrogen was negative during intermittent irrigation period.
- Pollutants runoff characteristic was affected by agricultural activities in paddy field watershed. Hence the unit load has to separate with agricultural activities.



Average net loading of TN due to agricultural activity during irrigation period

趙 晟佑 (植物分子細胞遺伝学)

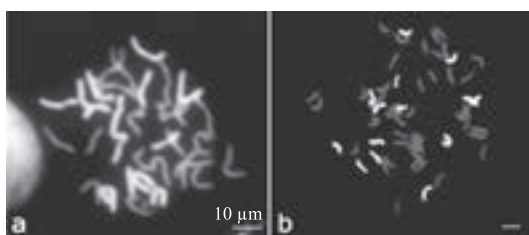
コムギは三大作物の1つであり、人にとって植物タンパク質の良い供給源である。しかし、近代育種における過度の選抜のためその遺伝的多様性は狭まっている。限られたコムギの遺伝変異は、その適応性と乾燥、塩害および病害のような生物的・非生物的ストレスに対する抵抗性を小さくしている。私の研究は乾燥地の育種のための遺伝資源としてコムギおよび野生植物の遺伝子工学に焦点を絞って行っている。

増加する世界の人口への食糧を確保するためには、厳しい環境下において生育し、適応性がより高く、高い収量性を示す作物が緊急に求められる。したがって、近縁野生種がコムギの育種に用いられる。様々な非生物ストレスに対して顕著な耐性と大きい根圏をもつハマニンニク (*Leymus mollis*, $2n=4x=28$, NsNsXmXm) は、コムギの有用な野生植物である。染色体工学技術を用い、私はこのおおハマニンニク由来の染色体をもつ新しいコムギの染色体添加系統を育成した。私の研究の主な目的は以下の通りである。

- 生物学的および化学的方法による減数分裂組換え頻度の改善
- ハマニンニク染色体添加コムギの育成
- コムギに導入された異種染色体を同定するための分子マーカー分析の開発

本年度は、これらの課題について以下の結果を得た。

1. 減数分裂時の組換え頻度改善のための欠失および正常なライムギの過剰B染色体をもつ植物の作製。ライムギのB染色体は同相染色体対合を誘導することが知られている。そこで、私は、コムギ内でライムギのB染色体が2種のハマニンニク属植物染色体間での接合を見るために、ハマニンニク、オオハマニンニクおよびライムギのB染色体またはその小型染色体をコムギの遺伝的背景にもつ植物を作った。
2. ハマニンニクの染色体をもつコムギ・ハマニンニク雑種の第3世代 (BC₁F₃) の作製。雑種第1世代 (F₁) は日本で一般的な品種「農林61号」とハマニンニクの間で育成した。
3. コムギの遺伝的背景において異種植物を同定するための大規模DNAマーカースクリーニング。コムギとハマニンニクの染色体添加系統の場合、ゲノミック *in situ* ハイブリダイゼーション法でコムギと異種染色体を識別することができる。しかし、正確なハマニンニク染色体の同定とグルーピングは極めて難しい。そこで、私は、コムギに導入されたそれぞれの異種染色体を同定するためにハマニンニクとオオムギのESTマーカーを分子レベルでスクリーニングした。



Chromosomal observation. (a) *L. mollis* chromosomes (bright) in F₁ hybrid plants. (b) *L. mollis* chromosomes (bright) in BC₁F₂ plants. 'Norin 61' chromosomes are dark.

Seong-Woo Cho (Plant Molecular Cytogenetics)

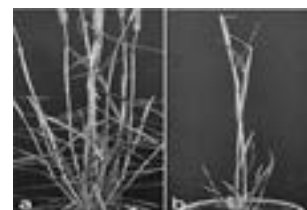
Wheat is one of three major cereal crops and a good source of vegetable protein for human. However, the genetic diversity of wheat is narrowed by excessive selection breeding in modern agriculture. The limited wheat genetic variation leads to less adaptation and tolerance to biotic and abiotic stresses such as drought, salinity and diseases. My research focuses on chromosome engineering on wheat and wild plants as genetic resources for breeding in arid land.

More adaptable and high yielding crops that can grow in harsh environments are urgently required to insure food security for the increasing world population. Hence, relative wild species are used for breeding improved wheat. *Leymus mollis* ($2n=4x=28$, NsNsXmXm), with its remarkable tolerance to various abiotic stresses and its long and dense rhizosphere is very useful relative of wheat. Using chromosome engineering technologies, I developed new wheat chromosome addition lines with added chromosomes derived from *L. mollis*. Main purposes of this research are as follows:

- Improvement of frequency of meiotic recombination by biological and chemical methods.
- Production of wheat-*L. mollis* chromosome addition lines
- Development of molecular markers analysis system to identify alien chromosomes in wheat.

In fiscal year 2012, I got the results from the above subjects as follows:

1. Production of plants with rye deficient and normal extra chromosomes (Bs) as biological method for improvement of frequency of meiotic recombination. It is known that rye Bs cause homoeologous recombination. Therefore, I produced the plant with *L. mollis*, *L. racemosus*, and rye B or rye small B in wheat genetic background to clarify effect of rye Bs on chromosome association between the two *Leymus* chromosomes in wheat.
2. Production of third generation wheat-*Leymus* hybrid that harbor chromosomes from *Leymus* (BC₁F₃). The first generation hybrid (F₁) was produced between the Japanese popular wheat cultivar Norin 61 and *L. mollis*.
3. Extensive DNA marker screening to identify alien chromosomes in wheat genetic background. In case of wheat-*L. mollis* chromosome addition lines, it can be distinguished between wheat and alien chromosomes using genomic *in situ* hybridization, but it is too hard to decide the exact *L. mollis* chromosome identity/group. Therefore, I screened *Leymus* and barley EST markers at molecular level to develop specific markers to identify each alien chromosome in wheat.



Phenotypic observation in F₁ hybrid

立石 麻紀子 (樹木生理生態学)

乾燥条件・高塩濃度条件において生育する植物の水利用の定量的評価、生理的特性の解析を通じて、乾燥地植物の耐乾・耐塩メカニズムを明らかにすることを目的とし、以下の3つのテーマで研究を行った。

1. 防風林樹種の蒸散特性の解明

強風・飛砂防止のために植林された小叶楊の生理・成長に及ぼす砂移動の影響を定量的評価することを目的として、内蒙古クブチ砂漠において砂丘の上部と下部に生育する小叶楊で水利用特性および成長量を比較した。樹液流速や飽差に対する応答に違いは見られなかったが、個葉スケールでは気孔コンダクタンス、蒸散速度ともに埋砂地の方が小さく、より乾燥に対応していることが考えられた。単木の樹液流量は埋砂地で大きく、葉面積が大きいことで個葉の気孔コンダクタンス低下を補っている結果となった。

2. 高塩分濃度の冠水が樹木の生理・生存に及ぼす影響の評価塩生植物の蒸散特性の解明

マングローブ林の潮汐や塩分濃度などの物理環境条件は場所によって大きく異なる。特に日本に生育するマングローブは分布域の北半球高緯度限界ラインに位置し比較的厳しい生育環境である。琉球大学と共同で日本のマングローブの主要構成樹種であるメヒルギ、オヒルギの蒸散特性を調べ、他の地域及び他の樹種との違いを明らかにすることを目的とした。樹液流速はオヒルギ、メヒルギともに潮汐に伴う水位変動の影響は見られず、日射と高い相関を示した。オヒルギがメヒルギの約2倍大きかったものの、日単木蒸散量は、既存のマングローブ植物の蒸散量に対して小さかった。

3. 高塩分濃度の冠水が樹木の生理・生存に及ぼす影響の評価

塩害や冠水による樹木の被害はある程度時間が経過してから現れる。したがって、海水による冠水実験によって樹木の反応の字形変化を追った。海水浸漬を24時間行ったタブノキでは、完水直後から樹液流速の減少、葉の変色が観察されたが、クロマツでは、処理後にも樹液流速は観察され、2ヶ月後にも枯死した個体はなかった。



Poplar trees in Kubuqi desert. Trees were gradually buried by sand (right).

Tateishi, Makiko (Tree-Eco-physiology)

Characteristics in water use of plant species growing in drought condition or high-salinity environment are investigated to clarify the mechanism of salt and drought tolerance. Three following topics are included in my study:

1. Effect of sand burial on water use and growth of Simon poplar in Kubuqi desert, Inner Mongolia of China.

Populus simonii is one of the effective species for revegetation in China, because of rapid growth, adventitious root formation and growth promotion by burial with sand. To evaluate the effect of sand burial on water use and growth of Simon poplar, we compared physiological characteristics of Simon poplar in upper and lower stands in growing season of 2012. Although sap flux density and its response to water vapor deficit were similar between the sites, leaf scale measurement of stomatal conductance and transpiration were smaller in the upper site than the lower site. Total sap flow was large in the upper site, which results from large leaf area.

2. Water use of salt-tolerant species

Microclimate and physical condition in Mangrove varies among the sites. In Japan, mangrove grows in Okinawa, which is located in northern limits of its distribution and seems to be in severe environment. Water use of two mangrove tree species was monitored with Ryukyu University to evaluate characteristics of water use and compare with that in other environment. Sap flux density was highly correlated with solar radiation, and not affected by tidal fluctuation. Both species had smaller water use than previous reports in tropical area.

3. Effect of flooding with sea water on physiological condition and survival of trees

Damages to trees by seawater or flooding are appeared by gradation. We monitored chronological changes of tree response after flooding with seawater. After 24 hours, sap flux density in *Machilus thunbergii* decreased and leaves got discolored. However, *Pinus thunbergii*, which is most popular in coastal forest, keep transpired two months after experiment.



Sap flux measurement with mangrove tree.

Ailijiang Maimaiti (植物生理生態学)

乾燥地の厳しい環境ストレス条件下に生育する植物を対象にストレス生理生態学的研究を行った。特に乾燥地植物の乾燥や塩に対する反応と耐乾燥、耐塩性に関するメカニズムの解明と耐乾燥、耐塩性の向上に関する研究を重点的に行った。本年度の主要な研究内容は以下のようである。

土壌および水に含まれる塩分は最も重要な環境ストレスとして野生の植物や作物の成長抑制することが広く知られている。このような塩害の防止、対策としては灌漑や排水の適正な管理、耐塩性植物の導入や耐塩性の向上が求められる。このためには対象となる植物について、塩ストレスに対する生理的応答を理解することが必要不可欠となる。本年度の研究は、中国原産のナシの一種で、現在は日本やヨーロッパでナシの台木として使用されている *Pyrus Betulaefolia* を対象として、塩ストレスに対する反応とその耐塩メカニズムの解明に関する研究を行った。実験は *P. betulifolia* の実生を 0-200 mM の塩類ストレス下で育成し、(i) 塩性環境下での成長や光合成特性、(ii) 異なる器官へのイオン蓄積、(iii) 植物体内における可溶性炭水化物類蓄積の時間変化等を調査した。

本年度の海外での研究活動としては、2013年6月12日~29日までアメリカのカリフォルニア大学リバーサイド校保全生物学研究センターを訪れ、乾燥地の現場で砂漠植物の生理について野外調査を行った。さらに、鳥取大学農学部の板井博士と共に中国の新疆農業大学森林および園芸学物とコルラのナシ研究所を訪問した。これらの訪問は2013年8月20日~29日の間に行われ、中国の新疆ウイグル自治区で広く栽培される園芸植物特にナシ類に関する調査を行った。



Growth changes of *P. betulifolia* seedlings at different NaCl concentrations

Ailijiang Maimaiti (Plant Eco-physiology)

1. Research Activities

The plant stress eco-physiological researches were conducted to elucidate eco-physiological characteristics of plant species growing in harsh environment. Particular efforts are being made to clarify the responses of plants to salt and drought stresses and relevant mechanisms, and to develop stress tolerance of planting species. The main research in the fiscal year was as follows:

Salinity in soil or water is one of the major abiotic stresses that reduce plant growth and crop productivity worldwide. The scale of the problem of salinization is considerable and continues to grow. Overcoming soil salinity problems can be approached by managing irrigation and drainage and/or selecting (or engineering) plants to increase their tolerance. Therefore, understanding the basic physiological responses of plants to salinity stress is crucial for agricultural productivity. Aims of research in the fiscal year were to identify the tolerance mechanism of *Pyrus Betulaefolia* (is native to northeast China and is now used as rootstocks for Japanese and European pear cultivation) to confront salt stress. The study evaluated the response of *P. betulifolia* seedlings to NaCl concentrations in the range 0-200 mM in terms of (i) growth and photosynthetic characteristics of *P. betulifolia* seedlings to salinity (ii) ion accumulation in different organs at various treatment period (iii) time course changes in soluble carbohydrates under salt stress.

Overseas research activities during the fiscal year 2013 include field researches at Center for Conservation Biology, University of California Riverside in the U.S from June 12 to 29, 2013. And, visit College of Forestry and Horticulture, Xinjiang Agricultural University and Korla Pear Research Center in Xinjiang, China, with Dr ITAI Akihiro (from Tottori Univ). We investigated some horticultural plants, especially pear, which is widely cultured in Xinjiang region from August 20 to 29, 2013.



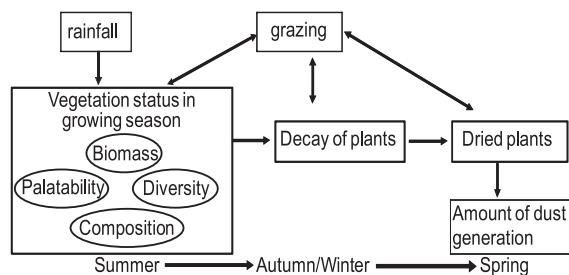
Field research at Center for Conservation Biology in the U.S.A

程 云湘 (植物生態学)

植物生態学分野では、乾燥地域における植物群落の成立や変化を理解・予測するために、植物群落タイプと環境条件の関係や、群落タイプが変化の環境条件の解明を目指している。特に近年の乾燥化および干ばつの頻発や強化が、植物群落に及ぼす影響を予測することは、ダスト発生と植生の関係を把握する研究、生態系全体の保全にとっても大きな意義がある。本年度は主に次の課題について研究が行われた。

- 放牧圧と耕作が内蒙古フルンベル草原の植生変化に及ぼす影響
- 中国北部における持続放牧と家畜排除の異なる管理政策が内蒙古草原に及ぼす影響

主な研究補助金は、「東アジア砂漠化地域における黄砂発生対策と人間・環境への影響評価」黄砂プロジェクト文部科学省特別経費である。



Relationship between the dust emission and rainfall/grazing/vegetation

Yunxiang Cheng (Plant Ecology)

The Plant Ecology conducts research on understanding and predicting the main drivers of plant community composition and species richness in arid and semi-arid lands. Especially, it is important to clarify the interaction between plant communities and environmental condition. Droughts frequently have become increasing in these years, particularly in the Mongolian plateau. Evaluating the impact of the drought to plant communities is important not only for comprehending the relationship between vegetation and dust emission, but also for overall ecological correctness. The main research topics in the fiscal year were as follows:

- Impact of grazing pressure and cultivation on species composition in Hulunbeier grassland of Inner Mongolia, China
- Influences of continuous grazing and livestock exclusion on vegetation in Inner Mongolian grassland, northern China

The main fellowship grant was as follows:
 “Assessment and Control of Dust Emission in Degraded Drylands of East Asia” Project Asian Dust

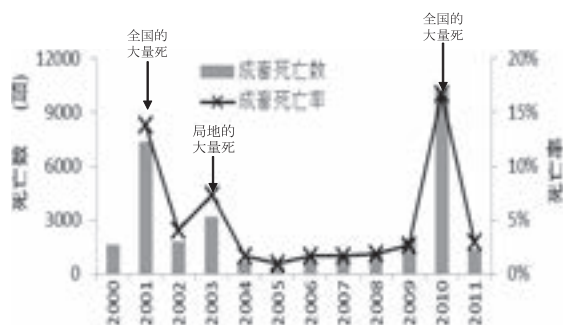


Field research in Otingdag sandy land, China

小池 崇子 (気候学)

モンゴル国に代表されるような、中高緯度の乾燥地の人々の暮らしは、夏の干ばつや冬の厳しい気象条件に繰り返し脅かされてきた。このような厳しい気候の中で、現地の人々は遊牧生活を代々続けてきた。牧畜業は現在もモンゴル国の主要産業の1つであるが、屋外での放牧はダイレクトに気象と牧草生育状態の影響を受けるため、毎年の様に国内のどこかで家畜の大量死が発生し、家畜数は不安定である。年間の家畜の死亡数のほとんどは、家畜の体力が最も弱くなる冬から春に集中している。私は家畜にとって厳しい気象条件について研究している。

本年度は、モンゴル北部のボルガン県のボルガン郡を対象領域とし、当領域において家畜大量死の発生した寒候季における、厳しい気象条件（異常低温、大量積雪、暴風雪等）に着目し、以下の結果を得た。現地の村単位の詳細な家畜統計資料を入手し、家畜死亡率を計算した結果、この領域では近年2000年以降3つの寒候季に家畜大量死が発生したことが明らかになった。1980年から2012年の現地気象台（ボルガン中央気象台）の地上観測データとを使って地上の局地的な気象条件を明らかにし、また全球再解析メッシュデータを利用して、地上で厳しい気象条件が発生したときの総観場のパターンを500 hPa 高度の強風軸に注目して明らかにした。10月から4月を寒候季とし、寒候季ごとの寒波の強さを地上気温の偏差を使って計算した。また日平均気温が -30°C 以下の日の数とその最長継続日数を算出した。さらに500 hPa の風のデータより、寒候季毎の偏西風の蛇行の強さを算出した。平常場における500 hPa の強風軸を含む領域を設定し、寒候季間のその領域内での東風成分の発生頻度を偏西風の蛇行の強さの指標とした。その結果、偏西風蛇行の強い寒候季には、寒波の強さの指標の負値が大きく ($r = -0.78$; $P < 0.01$)、異常低温日が多くまた長時間継続した ($r = 0.72$; $P < 0.01$) 傾向があったことが明らかになった。

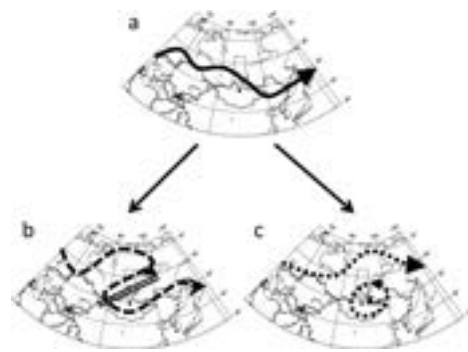


Number of livestock loss (bar) and mortality (solid line) in the Bulgan county.

Takako Koike (Climatology)

The livelihood of people inhabiting drylands in the middle-high latitudes (such as seen in Mongolia) has long been repeatedly jeopardized by summer drought and harsh winter conditions. In such a severe climate, people have continued nomadic life for a long time. Stock-farming is still one of basic industries in Mongolia. However, the number of livestock is still not instable, because their outside stock-farming style is affected directly by weather and pasture conditions. Most number of livestock loss of the year occur from winter to spring. My research is about harsh weather condition for livestock.

In fiscal year 2012, I obtained results as follows. I focused on harsh weather conditions (such as extremely cold air temperature, deep snow cover, and snow storm, etc.) in high mortality winters in a small research area, the Bulgan county in the Bulgan state, northern Mongolia. We collected local statistical data and revealed that high livestock mortality occurred during three cold seasons since 2000 in this area. Using locally observed data and global meshed re-analysis data, from 1980 to 2012, we explored features of weather conditions at the local ground level and the synoptic scale air circulation patterns focusing on westerlies' meandering at the 500 hPa level when the harsh weather conditions occurred there. For each cold season, from October to April, we calculated the seasonal intensity of cold surge with local daily temperature anomalies, and counted the number and duration of days with daily temperature below -30°C (used as critical cold days for livestock). Also, at upper air, we calculated the seasonal amplitude of westerlies' meandering inferred from the frequency of easterly winds within a particular area including climatological westerlies' axis. It has been shown that the intensity of cold surge was larger ($r = -0.78$; $P < 0.01$) and critical cold days for livestock continued longer ($r = 0.72$; $P < 0.01$) when westerlies' meandering was enhanced and maintained. Timely forecasting of strengthened meandering would help early warning to mitigate or prevent livestock mortality.



The westerlies' meandering (a) and its enhancing. (b) a inclined trough, (c) a cold vortex.

Meshesha, Derege Tsegaye (土壌侵食・堆積学)

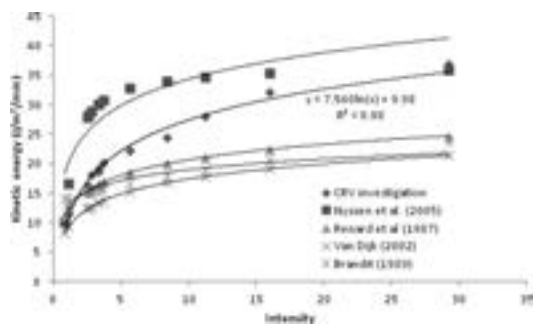
エチオピア高地における土地劣化は、強い降雨による土壌侵食力と貧弱な土壌保全策が大きな要因である。降雨侵食力は、ある土地から土壌を引きはがし、輸送する降雨エネルギーの能力を定量化するもので、土壌侵食の推定において用いられる主要な因子の1つである。侵食力の基本的な表現は、降雨の運動エネルギーと最大30分強度に基づくものである。しかし運動エネルギーは通常、雨量から推定することが難しく、その推定の部分がボトルネックとなる。なぜならば降雨運動エネルギーは降下速度 (V_t) と雨滴の粒径分布 (DSD) の結合された効果から得られるものだからである。したがって、DSD、降雨強度、および運動エネルギーなどの降雨特性の理解は土壌侵食の推定においてきわめて重要である。

そこで2012年度は、①降雨強度と運動エネルギーの関係の理解、②基本的降雨特性の評価、③その基本パラメータによるストームイベントの潜在侵食力の推定、④降雨侵食力の時間的変動および空間的分布と長期土壌侵食に対するその影響の評価を主たる目的とした。

その結果、本年度は主として以下のような成果が得られた。

降雨特性について：エチオピアの中央地溝帯において、基本的降雨特性（降雨の雨滴サイズ、強度、および運動エネルギー）を決定し、各降雨イベントに対する侵食力を評価した。

強度 (I) と運動エネルギー (K_{evol}) との関係について：研究対象地域およびエチオピア高地において適用可能な2つの基本的パラメータの間の関係を明らかにした。



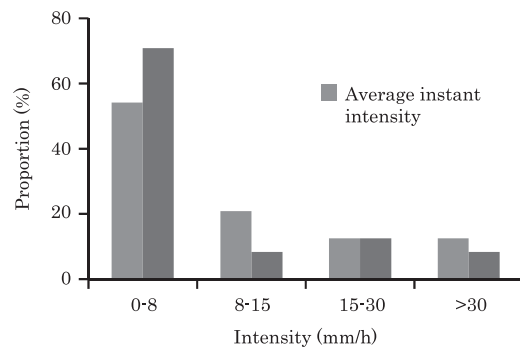
Intensity vs. kinetic energy our observation and others' equation

Derege Tsegaye Meshesha (Soil Erosion and Sedimentation)

Land degradation in many Ethiopian highlands occurs mainly due to high rainfall erosivity and poor soil conservation practices. Rainfall erosivity, which quantifies the ability of rainfall energy to detach and transport soil from a plot of land, is one of the major factors used for estimation of soil erosion. The basic expression of erosivity is based on the kinetic energy of the rain and its maximum 30 minute intensity. However, kinetic energy is always a bottle neck and difficult to estimate from a given rain, because the rain kinetic energy is obtained from the combined effects of the fall velocity (V_i) and drop size distribution (DSD) of raindrops. Therefore, understanding of rainfall characteristics such as DSD, intensity, and kinetic energy is very important for the prediction of soil erosion. Thus, my main objectives in fiscal year 2012 research activities were: 1) understand a relationship between rainfall intensity and kinetic energy, 2) evaluation of basic rainfall characteristics, 3) estimate erosivity potential of storm events from its basic parameters, and 4) assess temporal variation and spatial distribution of rainfall erosivity and its implication on long-term soil erosion.

Thereby, I specifically got the following results in this fiscal year:

- As to the character of rainfall, we determined the basic characteristics of rainfall (raindrop size distribution, intensity and kinetic energy) and evaluated erosivity for each rainfall event in Central Rift Valley of Ethiopia.
- As to the relationship between intensity (I) and kinetic energy (K_{evol}), we established a relationship between the two basic parameters that could be adopted in the area and the rest of the Ethiopian highlands.



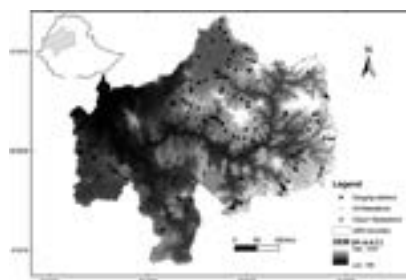
Average instant intensity obtained from the tipping bucket vs. normal intensity of each rainfall event.

Aychu, Nigussie Haregeweyn (日本学術振興会特別研究員)

乾燥地は、エチオピア国土 (110 万 Km²) の 67% を占める。農業セクターは、気候変動と土地劣化に対してもっとも脆弱である。青ナイル川上流域 (Upper Blue Nile basin : UBN) は流域面積 199,800 km² (図) を有する。エチオピアの乾燥地における気候変動に対する適応能力を強化し、脆弱性を減少させるため、水士壌保全および小規模灌漑に対する雨水集水 (ウォーターハーベスティング) が広く行われてきた。本研究の主たる目的は、ナイル川流域スケールでの気候変動適応における土地管理策の効果をモデル化し、その下流域への影響を定量化することである。この目的のため第一に、熱帯降雨観測衛星 (Tropical Rainfall Measuring Mission : TRMM) などの全球グリッド降水量データを校正・検証して用いることにより、当該流域における重要な気候 (降雨) データのギャップを埋めた。次にそれを用いて対象流域における月平均降雨量マップおよび年降雨量マップを作成した。第二に、ふたつの土地管理シナリオを策定した。

(1) 現在の土地利用条件、および (2) 流域土地管理策をアップスケールすることによって得られた 2025 年時点の土地利用条件である。第三に、流域管理策が流去反応に及ぼす効果を評価するため流去係数 (Runoff Coefficient : RC) アプローチを用いて、土地管理シナリオと空間降雨データを統合した。これらの分析に基づき、流域における水資源開発策に対する優先小流域として扱われるべき流去ホットスポット地域を特定することができた。これらの予備的解析結果から、ストーンバンド (等高線石積み)、エクスクロージャー (家畜よけの柵) などの流域管理の導入によって、2025 年までに流去損失を最大 40% まで削減することができることが結論づけられた。

現在の条件下で、年間流去量の空間変動は、流域の中心部における 80 mm から水面における 1,700 mm に至るまでの高い変動を有している。この変動は、主に表面条件、各土地利用タイプの空間範囲、および降雨量の変動によって制御されている。2025 年までに土地・水管理策によって、流域全体の総流去量を最大 40% 削減することが可能である。GERD 貯水池などの中規模から大規模貯水施設によって、他の土地利用から水面への転換の結果、流域におけるこれらの特定の部分では、最大 200% 流去反応が増大する。また将来、優先的に土地・水管理策を実施すべき小流域を特定することができた。これらの土地・水管理策が下流域における表面流去および土砂堆積に対する影響を理解するために、本研究をさらに継続している。



Location of the study area

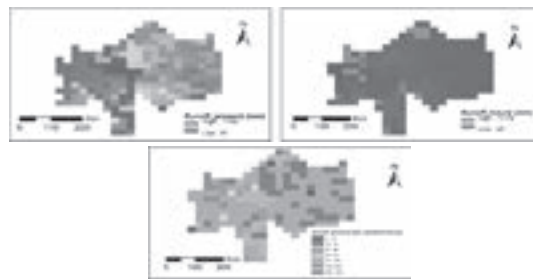
Nigussie Haregeweyn Aychu (JSPS Fellowship Researcher)

The drylands, which account for 67% of the Ethiopian total land mass (area=1.1×10⁶ km²), as well as, the agriculture sector have been identified as the most vulnerable to climate variability and land degradation. These problems are more prevalent in the Upper Blue Nile basin (UBN) which covers a drainage area of about 199,800 km² (Fig). To enhance the adaptive capacity and reduce the vulnerability to climate variability in the drylands of Ethiopia, soil and water conservation (SWC) and water harvesting for small-scale irrigation have been widely implemented

The main aim of our study is to model the significance of land management interventions in climate change adaptation at scale of Nile River basin and to quantify its downstream impacts. To address this objective, first, the important climate (rainfall) data gap in the basin were filled using calibrated and validated global gridded precipitation data sources such as Tropical Rainfall Measuring Mission (TRMM), and then applied to generate average monthly and annual rainfall map of the study basin. Second, two land management scenarios have been developed: (1) the present-day land use condition and (2) land use condition by the year 2025 constructed through upscaling the watershed land management interventions. Third, we integrated the land management scenarios and spatial rainfall data using the Runoff Coefficient (RC) approach to evaluate the effects of watershed management interventions on runoff response. On the bases of these analyses we could be able to identify runoff hotspot areas that give way to prioritization of sub-basins for water resources development interventions in the basin. From our preliminary analysis result, it can be concluded that introduction of watershed management measures such as stone bunds and, exclosures could reduce runoff loss by up to 40% by the year 2025.

Under present-day conditions, high spatial variability of annual runoff depth was observed in the UBN basin ranging from 80 mm in the central part of the basin to over 1,700 mm in water bodies. This variation is mainly controlled by variation in surface conditions and areal-extent of each land use type, and rainfall depth.

By 2025, due to the land and water management interventions, total runoff depth in the basin could decrease by up to 40%. Following the conversion of other land use types to water bodies due to the medium to large-scale water harvesting schemes such as GERD reservoir, runoff response in those specific parts of the basin could increase by over 200%. Sub-basins have been prioritized for future land and water management interventions. The study is ongoing to understand the downstream impacts of those interventions on runoff and sediment discharges.



Average annual runoff (mm) for the Upper Blue Nile (UBN) basin (present: upper left, future: upper right and their difference: lower).

Banzragch, Nandintseteg (日本学術振興会特別研究員)

本年度の研究では、次の2点に焦点をあてた。

- (1) 開発した生態系モデルを統合的風食スキームに組み込む。
- (2) アジアの草原地帯における干ばつ評価および干ばつに対する植生の脆弱性。

これらの研究活動について以下に簡単に説明する。

1. 開発した生態系モデルを統合的風食スキームに組み込む：

地表面パラメータの測定が可能な生態系モデル (DAYCENT) を開発した。この生態系モデル (DAYCENT) は草原での放牧、植物の成長および養分サイクルがもたらす影響を現実的にシミュレーションすることが可能である。また、風食モデルの権威である Shao 教授 (ドイツ、ケルン大学) の協力を得て、生態系モデル (DAYCENT) と併せて QF 2003 (図) を統合的風食スキームに組み込む作業を行った。この DAYCENT—QF 2003 連動モデルで黄砂発生予測の数値テストを行った結果、このモデルの可能性を明らかにすることができた。

2. 干ばつ評価および干ばつに対する植生の脆弱性：

干ばつ評価と干ばつが草原地帯の植生に与えるインパクトを調査した。新たに提示された干ばつに対する植生の感受性および復元力の指標を用いて、草原地帯の生態系が持つ脆弱性と不安定性の評価を行った結果、1999–2002年に頻発した干ばつの際に、アジアの草原地帯の中でも脆弱性を表した地域を特定することができた。

Nandintseteg Banzragch (JSPS Fellowship Researcher)

During April-October 2012, my research focused on (1) incorporation of developed ecosystem model into an integrated wind-erosion scheme and (2) drought assessment and vulnerability of vegetation to drought in the Asian temperate grasslands. Brief descriptions of my research activities are given below:

1. Incorporation of developed ecosystem model into an integrated wind-erosion scheme: We developed the DAYCENT ecosystem model for its capability to provide estimations of land-surface parameters, which suppressed dust events. Results showed that the DAYCENT could simulate realistically vegetation growth-decay, nutrient-cycle and the effect of grazing on grasslands. Then, we coupled the DAYCENT into wind-erosion scheme QF 2003 (Fig). This work was conducted in the collaboration with Prof. Yapping Shao (Cologne University, Germany), who is among the leading scientists on the wind-erosion model. We conducted the numerical test of the coupled DAYCENT-QF 2003 model to predict dust flux. With the initial results, we have demonstrated the potential of the DAYCENT-QF 2003 coupled model.

2. Drought assessment and vulnerability of vegetation to drought: Assessment of drought and its impacts on grassland vegetation was conducted. We evaluated grassland ecosystem vulnerability and instability, and identified hotspots on the Asian steppe that were vulnerable to widespread droughts during 1999–2002, using newly proposed indices of vegetation response (sensitivity and resilience) to drought.



Conceptual diagram of the coupled DAYCENT-QF 2003 model. QF 2003 interacts with the sub-models marked with the blue arrows

1.2 研究プロジェクト・教育プログラム

(1) 黄砂プロジェクト

東アジアにおける黄砂の発生メカニズム解明、黄砂の影響評価および発生源対策技術の開発に取り組む、「東アジア砂漠化地域における黄砂発生源対策と人間・環境への影響評価（通称：黄砂プロジェクト）」（平成23年度～平成27年度）が文部科学省特別経費事業に採択された。

本事業では、砂漠化に伴う砂塵嵐・黄砂被害が広がっているモンゴルや中国の乾燥地現場において砂塵嵐、黄砂の発生メカニズムの解明を行い、乾燥地の現場と黄砂影響を受ける日本国内において、黄砂が人間の健康、人間活動および自然生態系に与える影響解明を行う。さらに、発生国であるモンゴルや中国の現場において、効果的な砂塵嵐、黄砂の発生源対策に関する研究を行い、地域の実情に合った効果的な対処技術の開発を目指している。また、これまでの国際共同研究等で本センターが構築してきた学術ネットワークの活用により、モンゴル気象水環境研究所、モンゴル農業大学、中国内蒙古大学、中国内蒙古農業大学、中国科学院寒区旱区環境与行程研究所、アメリカ砂漠研究所、ドイツ・ケルン大学等と連携して研究を推進している。

研究内容

●黄砂発生メカニズムグループ（リーダー：篠田雅人）

- I. 黄砂発生における草原の空力学的・物理的影響の解明
- II. 草原植生の成長・衰退を再現するモデルの構築
- III. フィールド観測による既知の関係の広域展開
- IV. リモートセンシングによる黄砂発生パラメタの推定
- V. 黄砂発生パラメタと植生モデルの風食モデルへの統合

●黄砂影響評価グループ（リーダー：黒沢洋一）

- I. 人体への影響
 - ・日本の黄砂の生体影響（黄砂および微生物とアレルギー）
 - ・発生源での生体影響（モンゴル住民の長期的影響評価）
- II. 人間活動に与える影響
 - ・動物実験（慢性影響の評価）
 - ・モンゴルの家畜における植物中毒メカニズムの解明
- III. 自然生態系に与える影響（発生源対策グループと連携）
- IV. 農牧畜に与える影響
 - ・発生源での農牧畜に及ぼす影響
 - ・発生源での気候変動（干ばつ）と農牧畜の関係

●黄砂発生源対策グループ（リーダー：山中典和）

- I. 風食対策技術のレビューと効果検証（発生メカニズムグループと連携）
- II. 持続可能な飛砂防止緑化技術の開発
 - ・在来植生の回復技術開発
 - ・在来植物の植栽技術開発
- III. 黄砂が自然生態系に与える影響評価（影響評価グループと連携）

1.2 Research Projects and Training Programs

(1) Asian Dust Project

ALRC has started Asian Dust Project “Assessment and Control of Dust Emission in Degraded Drylands of East Asia” funded by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in FY 2011.

The aim of this project is to elucidate the sandstorm and dust emission mechanisms in the drylands of Mongolia and China, assess the effects of dust on human health, human activity and ecosystems in the source drylands and in Japan, and conduct research to develop effective measures to control sandstorms and dust emission in source areas.

We have been promoting collaborative research with the following international institutions: Institute of Meteorology, Hydrology and Environment (IMHE, Mongolia), Mongolian State University of Agriculture (MSUA, Mongolia), Inner Mongolia University (China), Inner Mongolia Agricultural University (China), Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences (CAREERI, CAS, China), Desert Research Institute (DRI, USA), University of Cologne (Germany), etc.

Research Summary

●Dust Emission Group (Leader: Shinoda, M.)

- I. Gain a deeper understanding of the aerodynamic and physical influences on grassland vegetation during wind erosion and dust emission processes
- II. Conduct vegetation modeling of seasonal growth and decay and of the impact of grazing
- III. Scale known relationships upwards to create a regional model
- IV. Quantify the critical parameters affecting dust emissions by using remote-sensing techniques
- V. Conduct integrated wind-erosion modeling that incorporates a grassland aeolian database and a vegetation model

●Effect Assessment Group (Leader: Kurozawa, Y.)

- I. Study the effects of dust on human health
 - ・Effects in Japan and source areas
- II. Analyze the effects of dust on human activity
 - ・Chronic effects of dust on animals
 - ・Livestock poisoning related to desertification in Mongolia
- III. Evaluate the effects of dust on ecosystems
- IV. Study the effects of dust on agriculture and livestock farming in dust source areas
 - ・Effect of dust on agriculture and livestock farming
 - ・Effect of climate change (drought) on agriculture and livestock farming

●Dust and Sandstorm Control Group (Leader: Yamanaka, N.)

- I. Review measures to reduce wind erosion and evaluate the effects of measures
- II. Develop sustainable measures to control dust and sandstorms
 - ・Develop the restoration technologies of original vegetation
 - ・Develop effective planting technologies for native plant species
- III. Evaluate the effects of dust on natural ecosystems

(2) ポスト GCOE プロジェクト (乾燥地科学)

本事業は、乾燥地研究センターを中心に実施した、文部科学省事業・グローバル COE プログラム「乾燥地科学拠点の世界展開」(平成 19 年度～平成 23 年度)で形成された拠点機能をさらに発展、向上させるため、鳥取大学独自の事業として、平成 24 年度から学際的なプロジェクト「ポスト GCOE プロジェクト (乾燥地科学)」を実施している (プロジェクトリーダー: 恒川篤史)。

プロジェクトの目標

本事業では、以下の 3 つを目標に推進している。

- ① 世界に通用する人材の育成
ポストドク、博士課程学生を中心とした若手研究者に対し、英語学術論文記述法研修の実施、国内・海外学会発表、海外調査の機会を与えるなどのメニューを準備し、研究力、現場力、語学力を持った人材を輩出する (人材育成リーダー: 北村義信)。
- ② 乾燥地における人と自然の持続性の維持・向上に貢献できる研究の推進・研究成果の発信
グローバル COE プログラムで実施した、砂漠化土地の環境修復に関する研究、乾燥地における持続的農業生産に関する研究などを継続実施し、得られた成果の発表を行うとともに、乾燥地の現場へ普及を図る。また、共同研究、他のプロジェクトとの連携研究も効果的に機能させ、独創的な研究成果を積極的に発信する。
- ③ 国際学術ネットワークの強化
乾燥地の現場と連携し、グローバルに活躍する人材の育成と国際共同研究の推進を図る。

研究活動

グローバル COE プログラムで形成された以下の 5 研究グループにおいて引き続き研究を発展させる。

- 分子育種グループ (リーダー: 辻本壽)
グローバル COE プログラムで開発した遺伝子組換え系統および異種遺伝子保有系統の耐寒性の評価を現場において行い、有効性を調査する。
- 農業生産グループ (リーダー: 藤山英保)
乾燥地における持続的農業生産に関する基礎研究及び現地、特に中国山東省での応用研究を継続する。
- 保健医学グループ (リーダー: 黒沢洋一)
黄砂の生体影響の解明と警報システム構築および発生源対策のための研究拠点をさらに発展させる。
- 地球環境グループ (リーダー: 篠田雅人)
モンゴルにおける観測・調査を継続し、地表面状態が黄砂発生の際風速に及ぼす影響評価を高度化し、黄砂発生ハザードマップを作成・公開する。
- 環境修復グループ (リーダー: 山中典和)
グローバル COE プログラムで実施した砂漠化土地の環境修復に関わる研究について引き続き実施し、得られた成果の発表を行う。

(2) Post-GCOE Project (Dryland Science)

Tottori University had conducted MEXT-funded project, Global COE Program “Global Center of Excellence for Dryland Science,” from FY 2007 to FY 2011, mainly led by the Arid Land Research Center. In order to further enhance the functions as the hub research institution, Tottori University has been conducting a multidisciplinary project in its own style, “Post-GCOE Project (Dryland Science)” since FY 2012. (Project Leader: Tsunekawa, A.)

This project promotes activities based on the following three goals.

- ① Foster human resources who are internationally active
Produce talented personnel who have research competencies, practical abilities and linguistic skills by providing young researchers with opportunities such as a training course of writing English papers, overseas surveys, presentations at international conferences, etc. (Personnel Development Leader: Kitamura, Y.)
- ② Promote research for supporting sustainability of the nature-society system in drylands and release research achievements
Conduct research on environmental restoration of desertified lands and sustainable agricultural production, publish the research outcomes on peer reviewed journals or books, and put the outcomes into practical use in arid regions. Promote joint and collaborative research with other national and international research institutions, and actively release unique research achievements to the public.
- ③ Strengthen the global academic network
Develop world-class human resources and promote international joint researches through collaboration with overseas research institutions that hold the fields of drylands.

Research Activity

- Molecular Breeding Group (Leader: Tsujimoto, H.)
Evaluate and investigate drought tolerance of transgenic lines and heterologous genes lines, which were developed during the time of Global COE Program in the fields of drylands.
- Agricultural Production Group (Leader: Fujiyama, H.)
Continue the basic research on sustainable agricultural production and the applied research in Shandong Province which have been conducting since the time of Global COE Program.
- Health and Medicine Group (Leader: Kurozawa, Y.)
Develop a research center to analyze effects of Asian dust on health, establish an alarm system, and monitor and control source of dust emission.
- Global Environment Group (Leader: Shinoda, M.)
Conduct observation and study in Mongolia, sophisticate the environmental estimation of the wind velocity of dust emission which is affected by ground surface, and create and publish a dust hazard map.
- Environment Restoration Group (Leader: Yamanaka, N.)
Continually conduct research on environmental restoration of desertified lands which started under the Global COE Program, and publish the achievements on peer reviewed journals and books.

(3) 若手研究者インターナショナル・トレーニング・プログラム (ITP)

若手研究者インターナショナル・トレーニング・プログラム (ITP) は、独立行政法人日本学術振興会が、平成 19 年度より実施している事業であり、鳥取大学が採択されたプログラム「乾燥地における統合的資源管理のための人材育成」は平成 20 年度から平成 24 年まで 5 年間実施した。

本事業は、鳥取大学で最も実績のある乾燥地分野において、国際的通用性のある若手研究者、すなわち海外の大学、国連機関、国際機関等、世界の大学や研究機関で職責にふさわしいミッションを十分にこなすなど、国際的に活躍する人材を養成することを目標に実施した。

鳥取大学のプログラムでは、修士課程の学生が、最長 1 年間海外の研究機関に滞在し、チュニジア、シリア、中国の学生と共に、乾燥地に関する広範な内容の講義と乾燥地をフィールドとした研究を行った。講義や研究指導は全て英語で行われ、多国籍の学生と生活を共にしながら、共に学び、研究することにより、豊かな国際感覚と語学力が磨かれた。

また、国際連合大学ほか 7 機関の共同による国際修士号プログラムである『乾燥地における統合的管理に関する共同修士号プログラム (略称：MS プログラム)』を活用して、このプログラムをより発展・拡充させ、修士課程学生を含む若手研究者を育成した。

海外のパートナー機関

国際連合大学 (カナダ)、中国科学院寒区旱区環境工學研究所 (中国)、乾燥地域研究所 (チュニジア)、チュニジア国立農業研究所 (チュニジア)、国際乾燥地農業研究センター (シリア)、バリー地中海農學研究所 (イタリア)、国連砂漠化対処条約地球機構 (イタリア)

(4) 組織的な若手研究者等海外派遣プログラム

組織的な若手研究者等海外派遣プログラムは、独立行政法人日本学術振興会が実施している事業である。鳥取大学では、若手研究者等 (大学院生、ポスドク、助教、講師) を海外の研究協力機関へ派遣し、国際舞台で活躍できる優秀な若手研究者の育成を目指して、平成 22 年 2 月から平成 25 年 1 月まで 3 年間実施した。

派遣者総数は 43 名、うち 2 か月以上の派遣者数は 18 名であった。

派遣先機関における主な研究内容

- 砂漠化土地の修復
- 農業生産の向上
- 黄砂発生のフィールド観測
- ダスト観測技術開発

(3) JSPS International Training Program (ITP)

International Training Program (ITP) was launched in FY 2007 by the Japan Society for the Promotion of Science (JSPS). Tottori University's proposed program "Capacity Building for Integrated Resource Management in Drylands" was selected by JSPS, and we had conducted the program for five years from FY 2008 through FY 2012.

The aim of this program was to develop world-class young researchers in the field of dryland research. This human resource development program was designed to train talented professionals who would execute their missions at universities abroad, United Nations organizations, and other international research institutions.

Under this program, Tottori University had sent master's course students to overseas research institutions in Tunisia, Syria, China, etc. for a maximum of 12 months. Students attended lectures on wide-range subjects about dryland study and conducted field research. Since all lectures and research guidance were offered in English and students were surrounded by international group of people, the participating students had developed an international mentality and gained advanced linguistic skills.

In addition, in order to further develop and expand this program to nurture young researchers, we took full advantage of "the Joint Master's Degree Program on Integrated Drylands Management (MS Program)". The MS Program is offered jointly through a collaborative partnership between the United Nations University and seven other institutions, including Tottori University.

International Partner Institutions

United Nations University (Canada), the Cold and Arid Regions Environmental and Engineering Research Institute, CAS (China), the Arid Regions Institute (Tunisia), the National Agronomic Institute of Tunisia (Tunisia), the International Center for Agricultural Research in the Dry Areas (Syria), the Mediterranean Agronomic Institute of Bari, CI-HEAM (Italy), the Global Mechanism of the United Nations Convention to Combat Desertification (Italy)

(4) JSPS Institutional Program for Young Researcher Overseas Visits

"The International Program for Young Researcher Overseas Visits" was established by the Japan Society for the Promotion of Science (JSPS). Under the JSPS sponsorship, Tottori University, led by the Arid land Research Center, had conducted a program titled "International Capacity Building for Dryland Science" for three years from February 2010 through January 2013. The goal of this program was to nurture competent, internationally-active young researchers. We had sent a total of 43 young researchers, including junior associate professors, assistant professors, postdoctoral researchers and graduate students, to overseas partner institutions.

Main Research Contents at Overseas Institutions

- Restoration of desertified areas
- Improvement of agricultural production
- Field observation of aeolian dust outbreaks
- Development of dust observation technique

海外の研究協力機関

砂漠研究所（米国）、カリフォルニア大学リバーサイド校（米国）、カリフォルニア大学デービス校（米国）、国際乾燥地農業研究センター（シリア）、国立農牧林業研究所（メキシコ）、中国科学院寒区旱区環境工学研究所（中国）、中国科学院水土保持研究所（中国）、モンゴル気象水文環境研究所（モンゴル）

(5) 卓越した大学院拠点形成支援補助金

鳥取大学は、文部科学省の平成 24 年度研究拠点形成費等補助金「卓越した大学院拠点形成支援補助金」に採択された。本補助金は、優秀な学生をひきつけ、世界で活躍できる研究者を輩出する環境作りを推進することを目的として、優れた研究基盤を活かし高度な教育と研究を融合する卓越した拠点を有する大学に対し、博士課程の学生が学修研究に専念する環境を整備するため実施された事業である。

鳥取大学は平成 19 年度～平成 23 年度に実施したグローバル COE プログラム「乾燥地科学拠点の世界展開」の中間評価が A 評価であったこと等、本補助金事業の申請要件を満たしていたことから、平成 24 年 10 月に申請し、同年 12 月に採択された。

本補助金の平成 24 年度における主な経費使用実績は以下の通りである。

- 博士課程学生のリサーチ・アシスタント雇用 8 名
- 外国旅費 20 名
 - ・ 第 11 回乾燥地開発国際会議（ICDD）参加
 - ・ 外国人研究者のセミナー招聘
 - ・ 研究調査
- 国内旅費 9 名
 - ・ 学会参加
 - ・ 研究調査
- 英文論文校閲料 15 名

その他、博士課程における教育研究指導に必要な人件費、物品費、学会等参加費、等

Overseas Partner Institutions

Desert Research Institute (USA), University of California, Riverside (USA), University of California, Davis (USA), the International Center for Agricultural Research in the Dry Areas (Syria), National Institute of Forestry, Agricultural and Animal Research (Mexico), the Cold and Arid Regions Environmental and Engineering Research Institute, CAS (China), the Institute of Soil and Water Conservation, CAS and MWR (China), the Institute of Meteorology, Hydrology and Environment of Mongolia (Mongolia)

(5) MEXT Grants for Formation and Development of the Outstanding Hub Graduate Schools

Tottori University has been selected by MEXT for an “MEXT Grant for Formation and Development of Outstanding Hub Graduate Schools,” a subsidy for the cost of forming its research center in 2012. This subsidy is a project established for the purpose of promoting the creation of environments that will attract top students to nurture researchers qualified to be active around the world, by encouraging the formation of environments for students in Doctoral Courses to specialize in academic research at universities with superior centers that take advance of their first-class research infrastructures to combine advanced education and research.

Tottori University applied in October 2012 and was accepted in December of the same year, when it had satisfied essential conditions to apply for the subsidy by, for example, receiving an A grade in an interim evaluation for its Global COE Program, “Global Center of Excellence for Dry Land Science,” which it implemented from FY 2007 to FY 2011.

The major expenses covered by the subsidy in FY 2012 were as shown below.

- Employment of doctoral students as research assistants
- Overseas travel expenses
 - ・ Participation in the 11 th International Conference on Development of Drylands (ICDD)
 - ・ Invitation of researchers from overseas to hold seminars
 - ・ Overseas research
- Travel expenses within Japan
 - ・ Participation in academic conferences
 - ・ Research
- English language editing by professional editors for paper publication

Others were personal costs, costs of materials, and cost of participation in academic associations etc., necessary to guide education and research in a Doctors Course.

1.3 共同研究 / Joint Research

(1) 共同研究リスト / List of Joint Research

1) 重点研究 / Focused Research

重点研究 1 (F 1) Forces Research 1 (F 1)	対応教員 Corresponding Staff:	木村 玲二 Kimura, Reiji
研究代表者 Principal Researchers	田川 公太郎 (鳥取大学地域学部) Tagawa, Kotaro (Faculty of Regional Sciences, Tottori University)	
研究課題 Research Subject	砂漠緑化のための太陽光・風力併用発電を用いた海水揚水・灌漑水生成システムの実証試験 Field test of seawater pumping and irrigation water making system using solar and wind power for greening the desert	
研究分担者 Co-researchers	藤巻 晴行 (鳥取大学乾燥地研究センター)、井上 光弘 (鳥取大学乾燥地研究センター)、筒井 一伸 (鳥取大学地域学部)、林 農 (名古屋産業科学研究所研究部)、李 亜利 (鳥取大学大学院地域学研究科)、百崎 太郎 (鳥取大学大学院地域学研究科) Fujimaki, Haruyuki (Arid Land Research Center, Tottori University) Inoue, Mitsuhiro (Arid Land Research Center, Tottori University) Tsutsui, Kazunobu (Faculty of Regional Sciences, Tottori University) Hayashi, Tsutomu (Department of Research, Nagoya Industrial Science Research Institute) Li, Yali (Graduate School of Regional Sciences, Tottori University) Momosaki, Taro (Graduate School of Regional Sciences, Tottori University)	
重点研究 2 (F 2) Forces Research 2 (F 2)	対応教員 Corresponding Staff:	辻本 壽 Tsujimoto, Hisashi
研究代表者 Principal Researchers	明石 欣也 (鳥取大学農学部) Akashi, Kinya (Faculty of Agriculture, Tottori University)	
研究課題 Research Subject	悪環境下におけるジャトロファ花成・登熟および代謝調節技術によるバイオ燃料生産強化のシステム開発 A systematic approach for the fortification of biodiesel production via engineering of flowering, fruit maturation and metabolic control in Jatropha under adverse environmental conditions	
研究分担者 Co-researchers	アミン エルサディグ (鳥取大学乾燥地研究センター)、田中 浄 (鳥取大学農学部)、坪 充 (鳥取大学乾燥地研究センター)、安藤 孝之 (鳥取大学乾燥地研究センター)、恒川 篤史 (鳥取大学乾燥地研究センター) Amin Elsadig (Arid Land Research Center, Tottori University) Tanaka, Kiyoshi (Faculty of Agriculture, Tottori University) Tsubo, Mitsuru (Arid Land Research Center, Tottori University) Ando, Takayuki (Arid Land Research Center, Tottori University) Tsunekawa, Atsushi (Arid Land Research Center, Tottori University)	
重点研究 3 (F 3) Forces Research 3 (F 3)	対応教員 Corresponding Staff:	恒川 篤史 Tsunekawa, Atsushi
研究代表者 Principal Researchers	福井 希一 (大阪大学工学研究科) Fukui, Kiichi (Graduate School of Engineering, Osaka University)	
研究課題 Research Subject	環境ストレス耐性向上のための形質転換植物の作製及び DNA マーカーを用いた在来・野生系統の選抜と環境再現装置を用いた耐環境ストレス能の評価 Production of genetically-engineered plants and selection of native or wild lines for improvement of the stress tolerance, and evaluation of the tolerance by using environment simulators	
研究分担者 Co-researchers	辻本 壽 (鳥取大学乾燥地研究センター)、酒井 啓江 (大阪大学工学研究科)、モハメド アーメド (大阪大学工学研究科)、ビクター ベシナ キンテロ (INIFAP CIRCE)、レオバルド イラチェタ ドンファン (INIFAP CIRPAS)、ホセ ルイス ソリス ボニリャ (INIFAP CIRPAS)、安藤 孝之 (鳥取大学乾燥地研究センター)、辻 渉 (鳥取大学農学部)、万代 文子 (大阪大学工学研究科)、笹井 智博 (大阪大学工学研究科)、アルフレド ザマリパ コルメネロ (INIFAP CIRPAS)、土本 卓 (大阪大学工学研究科)、ホセ ルイス アナヤ ロベス (INIFAP CIRCE)、湯浅 彰太 (大阪大学工学研究科)、留森 寿士 (鳥取大学乾燥地研究センター) Tsujimoto, Hisashi (Arid Land Research Center, Tottori University) Sakai, Hiroe (Graduate School of Engineering, Osaka University) Mohammed Ahmed (Graduate School of Engineering, Osaka University) Víctor Pecina Quintero (INIFAP CIRCE) Leobardo Iracheta Donjuan (INIFAP CIRPAS) José Luis Solís Bonilla (INIFAP CIRPAS) Ando, Takayuki (Arid Land Research Center, Tottori University) Tsuji, Wataru (Faculty of Agriculture, Tottori University) Mandai, Ayako (Graduate School of Engineering, Osaka University) Sasai, Tomohiro (Graduate School of Engineering, Osaka University) Alfredo Zamarripa Colmenero (INIFAP CIRPAS) Tsuchimoto, Suguru (Graduate School of Engineering, Osaka University) José Luis Anaya López (INIFAP CIRCE) Yuasa, Syota (Graduate School of Engineering, Osaka University) Tomemori, Hisashi (Arid	

	Land Research Center, Tottori University)	
重点研究 4 (F 4) Forces Research 4 (F 4)	対応教員 Corresponding Staff:	山中 典和 Yamanaka, Norikazu
研究代表者 Principal Researchers	金 紅実 (龍谷大学政策学部) Jin, Hongshi (Faculty of policy Science, Ryukoku University)	
研究課題 Research Subject	中国の西部乾燥地域における鉱山資源開発と植生回復政策の執行過程における仕組みと現状に関する研究—内モンゴル自治区烏海市を事例に— A study on the enforcement process and the mechanism, current state of mineral resources development and vegetation recovery policy in arid areas of western China	
研究分担者 Co-researchers	窪田 順平 (総合地球環境学研究所研究部)、北川 秀樹 (龍谷大学政策学部) Kubota, Jumpei (Research Institute for Humanity and Nature) Kitagawa, Hideki (Faculty of Policy Science, Ryukoku University)	

2) 一般研究 / General Research

一般研究 1 (G 1) General Research 1 (G 1)	対応教員 Corresponding Staff:	篠田 雅人 Shinoda, Masato
研究代表者 Principal Researchers	飯島 慈裕 (独立行政法人海洋研究開発機構地球環境変動領域) Iijima, Yoshihiro (Research Institute for Global Change, Japan Agency for Marine-Earth Science and Technology)	
研究課題 Research Subject	気候傾度に沿ったカザフスタン—モンゴルステップトランセクトにおける草原生態系変動 Grassland dynamics in relation to climatic gradients in trans-steppe transect from Kazakhstan to Mongolia	

一般研究 2 (G 2) General Research 2 (G 2)	対応教員 Corresponding Staff:	篠田 雅人 Shinoda, Masato
研究代表者 Principal Researchers	鹿島 薫 (九州大学理学研究院) Kashima, Kaoru (Faculty of Sciences, Kyushu University)	
研究課題 Research Subject	モンゴルにおける水資源環境の長期的変動の復元 Long-term Monitoring of Water Resources in Mongolia	
研究分担者 Co-researchers	Aleksandr Orkhonselenge (金沢大学環日本海域環境研究センター) Ulgiichimeg Ganzorig (モンゴル科学院地理学研究所) 福本 侑 (九州大学大学院理学府) Aleksandr Orkhonselenge (The Institute of Nature and Environmental Technology, Kanazawa University) Ulgiichimeg Ganzorig (Institute of Geography, Mongolia Academy of Science) Fukumoto, Yu (Faculty of Sciences, Kyuushu University)	

一般研究 3 (G 3) General Research 3 (G 3)	対応教員 Corresponding Staff:	篠田 雅人 Shinoda, Masato
研究代表者 Principal Researchers	北川 博史 (岡山大学大学院社会文化科学研究科) Kitagawa, Hirofumi (Graduate School of Humanities and Social Sciences, Okayama University)	
研究課題 Research Subject	乾燥地都市における経済開発とその特性—北米地域を事例として— Economic Development and its Character in Arid Land—A Case Study on Cities in North America—	

一般研究 4 (G 4) General Research 4 (G 4)	対応教員 Corresponding Staff:	篠田 雅人 Shinoda, Masato
研究代表者 Principal Researchers	木村 圭司 (北海道大学大学院情報科学研究科) Kimura, Keiji (Graduate School of Information Science and Technology, Hokkaido University)	
研究課題 Research Subject	夏季モンゴルにおける低気圧・前線の構造と降水量変動に関する研究 A study of precipitation variation in relation to the structure of cyclones and fronts in summer Mongolia	

一般研究 5 (G 5) General Research 5 (G 5)	対応教員 Corresponding Staff:	篠田 雅人 Shinoda, Masato
--	------------------------------	--------------------------

研究代表者 Principal Researchers	山下 博樹 (鳥取大学地域学部) Yamashita, Hiroki (Faculty of Regional Sciences, Tottori University)	
研究課題 Research Subject	アメリカ合衆国南西部における都市開発の多様性と小規模中心地の盛衰に関する研究 The diversity of urban developments and vicissitude of the small centers in the south-western part of USA	
一般研究 6 (G 6) General Research 6 (G 6)	対応教員 Corresponding Staff:	篠田 雅人 Shinoda, Masato
研究代表者 Principal Researchers	中野 智子 (中央大学経済学部) Nakano, Tomoko (Faculty of Economics, Chuo University)	
研究課題 Research Subject	土壌の凍結・融解にともなう CO ₂ 放出の測定 Soil CO ₂ emission during freezing-thawing cycles	
一般研究 7 (G 7) General Research 7 (G 7)	対応教員 Corresponding Staff:	篠田 雅人 Shinoda, Masato
研究代表者 Principal Researchers	三上 正男 (気象研究所環境・応用気象研究部) Mikami, Masao (Atmospheric Environment and Applied Meteorology Research Department, Meteorological Research Institute)	
研究課題 Research Subject	北東アジア半乾燥地帯における黄砂発生メカニズムの機構解明に関する観測的研究 Observation on dust emission processes on semi-arid region in Northeastern Asia.	
研究分担者 Co-researchers	石塚 正秀 (香川大学工学部) 山田 豊 (理化学研究所先端工作支援チーム) Ishizuka, Masahide (Faculty of Engineering, Kagawa University) Yamada, Yutaka (RIKEN Advanced Manufacturing Team)	
一般研究 8 (G 8) General Research 8 (G 8)	対応教員 Corresponding Staff:	篠田 雅人 Shinoda, Masato
研究代表者 Principal Researchers	立入 郁 (独立行政法人海洋研究開発機構地球環境変動領域) Tachiiri, Kaoru (Research Institute for Global Change, Japan Agency for Marine-Earth Science and Technology)	
研究課題 Research Subject	モンゴル草原地域における放牧圧の推定とその陸域生態系モデルへの導入 Estimating grazing pressure in Mogolian grasslands and its incorporation to a terrestrial ecosystem model	
一般研究 9 (G 9) General Research 9 (G 9)	対応教員 Corresponding Staff:	木村 玲二 Kimura, Reiji
研究代表者 Principal Researchers	多炭 雅博 (宮崎大学農学部) Tasumi, Masahiro (Faculty of Agriculture, University of Miyazaki)	
研究課題 Research Subject	黄砂発生源における蒸発散量推定技術の適用評価について Evaluation of evapotranspiration estimation technique for yellow-dust monitoring	
研究分担者 Co-researchers	藤井 愛子 (宮崎大学農学部) Fujii, Aiko (Faculty of Agriculture, University of Miyazaki)	
一般研究 10 (G 10) General Research 10 (G 10)	対応教員 Corresponding Staff:	木村 玲二 Kimura, Reiji
研究代表者 Principal Researchers	加藤 博 (一橋大学大学院経済学研究科) Kato, Hiroshi (Graduate School of Economics, Hitotsubashi University)	
研究課題 Research Subject	乾燥地エジプトの灌漑耕作システムの学際的研究 Multi-disciplinary study of irrigation and cultivation system of arid land, case of Egypt	
研究分担者 Co-researchers	長谷川 奏 (早稲田大学エジプト学研究所) 岩崎 えり奈 (共立女子大学文芸学部) 松岡 延浩 (千葉大学大学院園芸学研究科) サルワ エルベイリモート (センシング空間科学国立研究所) 藤巻 晴行 (鳥取大学乾燥地研究センター) サイエド ザゲルール (リモートセンシング空間科学国立研究所)	

	Hasegawa, So (Institute of Egyptology, Waseda University) Iwasaki, Erina (Faculty of Arts and Letters, Kyoritsu Women's University) Matsuoka, Nobuhiro (Graduate School of Horticulture, Chiba University) Salwa Elbeih (National Authority for Remote Sensing and Space Sciences) Fujimaki, Haruyuki (Arid Land Research Center, Tottori University) Sayeed Zaghoul (National Authority for Remote Sensing and Space Sciences)	
一般研究 11 (G 11) General Research 11 (G 11)	対応教員 Corresponding Staff:	木村 玲二 Kimura, Reiji
研究代表者 Principal Researchers	松岡 延浩 (千葉大学大学院園芸学研究科) Matsuoka, Nobuhiro (Graduate School of Horticulture, Chiba University)	
研究課題 Research Subject	エジプト西部砂漠のオアシスで行われている輪作体系に対する灌漑時期の最適化 Optimization of irrigation period for the crop rotation system in oasis of the Western Desert, Egypt	
研究分担者 Co-researchers	加藤 博 (一橋大学大学院経済学研究科) 岩崎 えり奈 (共立女子大学文芸学部) 西脇 彩香 (千葉大学大学院園芸学研究科) Kato, Hiroshi (Graduate School of Economy, Hitotsubashi University) Iwasaki, Erina (Faculty of Arts and Letters, Kyoritsu Women's University) Nishikawa, Ayaka (Graduate School of Horticulture, Chiba University)	
一般研究 12 (G 12) General Research 12 (G 12)	対応教員 Corresponding Staff:	安田 裕 Yasuda, Hiroshi
研究代表者 Principal Researchers	中川 啓 (長崎大学水産・環境科学総合研究科) Nakagawa, Kei (Graduate School of Fisheries Science and Environmental Studies, Nagasaki University)	
研究課題 Research Subject	乾燥地における地下水と土壌環境に対する植生の影響 Effect of phreatophyte on groundwater and soil in arid environment	
研究分担者 Co-researchers	河合 隆行 (鳥取大学産学地域連携推進機構) Kawai, Takayuki (Organization for Regional Industrial Academic Cooperation, Tottori University)	
一般研究 13 (G 13) General Research 13 (G 13)	対応教員 Corresponding Staff:	安田 裕 Yasuda, Hiroshi
研究代表者 Principal Researchers	依田 清胤 (石巻専修大学理工学部基礎理学科) Yoda, Kiyotsugu (Faculty of Science and Engineering, Ishinomaki Senshu University)	
研究課題 Research Subject	マメ科低木メスキート実生の発芽・成長過程に対する浸透圧と温度の影響評価 Evaluation of the effects of osmotic pressure and temperature on germination and growth of Mesquite seedlings	
研究分担者 Co-researchers	辻 渉 (鳥取大学農学部) 井上 知恵 (鳥取大学乾燥地研究センター) 齋藤 忠臣 (鳥取大学農学部) モハメド エルバシット (鳥取大学乾燥地研究センター) アフメッド エルドマ (スーダン科学技術大学林学部) Tsuji, Wataru (Faculty of Agriculture, Tottori University) Inoue, Tomoe (Arid Land Research Center, Tottori University) Saito, Tadaomi (Faculty of Agriculture, Tottori University) Mohamed Abd Elbasit Mohamed Ahmed (Arid Land Research Center, Tottori University) Ahmed Eldoma (College of Forestry and Range Science, Sudan University of Science and Technology)	
一般研究 14 (G 14) General Research 14 (G 14)	対応教員 Corresponding Staff:	辻本 壽 Tsujiimoto, Hisashi
研究代表者 Principal Researchers	近江戸 伸子 (神戸大学大学院人間発達科学研究科) Ohmido, Nobuko (Graduate School of Human Development and Environment, Kobe University)	
研究課題 Research Subject	油糧植物ジャトロファの早期開花組換え体創出に関する研究 Production of Early Flowering Jatropha by transgenic method	
一般研究 15 (G 15) General Research 15 (G 15)	対応教員 Corresponding Staff:	辻本 壽 Tsujiimoto, Hisashi

研究代表者 Principal Researchers	佐藤 和広 (岡山大学資源植物科学研究所) Sato, Kazuhiro (Institute of Plant Science and Resources, Okayama University)	
研究課題 Research Subject	耐塩性オオムギの評価と遺伝子マッピング Evaluation and genetic mapping of salt tolerance in barley	
一般研究 16 (G 16) General Research 16 (G 16)	対応教員 Corresponding Staff:	辻本 壽 Tsuji moto, Hisashi
研究代表者 Principal Researchers	寺地 徹 (京都産業大学総合生命科学部) Terachi, Toru (Faculty of Life Sciences, Kyoto Sangyo University)	
研究課題 Research Subject	葉緑体の形質転換技術を用いたストレス耐性コムギの作出 Production of stress tolerant wheat through the use of chloroplast transformation technology	
研究分担者 Co-researchers	山岸 博 (京都産業大学総合生命科学部) 辻村 真衣 (京都産業大学総合生命科学部) Yamagishi, Hiroshi (Faculty of Life Sciences, Kyoto Sangyo University) Tsujimura, Mai (Faculty of Life Sciences, Kyoto Sangyo University)	
一般研究 17 (G 17) General Research 17 (G 17)	対応教員 Corresponding Staff:	辻本 壽 Tsuji moto, Hisashi
研究代表者 Principal Researchers	岸井 正浩 (横浜市立大学木原生物学研究所) Kishii, Masahiro (Kihara Institute for Biological Research, Yokohama City University)	
研究課題 Research Subject	オオハマニンニク染色体添加および転座コムギ系統からの耐塩性系統選抜 Screening of salinity tolerance lines from <i>Leymus racemosus</i> chromosome addition and translocation lines of wheat	
一般研究 18 (G 18) General Research 18 (G 18)	対応教員 Corresponding Staff:	恒川 篤史 Tsunekawa, Atsushi
研究代表者 Principal Researchers	坂本 敦 (広島大学大学院理学研究科) Sakamoto, Atsushi (Graduate School of Science, Hiroshima University)	
研究課題 Research Subject	核酸塩基代謝に隠された植物のストレス適応戦略の解明 Revealing a hidden role of nucleobase metabolism in plant strategies coping with stress	
研究分担者 Co-researchers	渡邊 俊介 (広島大学大学院理学研究科) Watanabe, Shunsuke (Graduate School of Science, Hiroshima University)	
一般研究 19 (G 19) General Research 19 (G 19)	対応教員 Corresponding Staff:	恒川 篤史 Tsunekawa, Atsushi
研究代表者 Principal Researchers	村上 健介 (鳥取大学工学部ものづくり教育実践センター) Murakami, Kensuke (Innovation Center for Engineering Education, Tottori University)	
研究課題 Research Subject	乾燥地での観測設備・機器を守るスマートセキュリティシステムの開発 Development of the smart security system protecting the observation equipment and apparatus in an arid land	
研究分担者 Co-researchers	藤巻 晴行 (鳥取大学乾燥地研究センター) 伊藤 健彦 (鳥取大学乾燥地研究センター) Fujimaki, Haruyuki (Arid Land Research Center, Tottori University) Ito, Takehiko (Arid Land Research Center, Tottori University)	
一般研究 20 (G 20) General Research 20 (G 20)	対応教員 Corresponding Staff:	恒川 篤史 Tsunekawa, Atsushi
研究代表者 Principal Researchers	田村 憲司 (筑波大学生命環境系) Tamura, Kenji (Faculty of Life and Environmental Sciences, University of Tsukuba)	
研究課題 Research Subject	半乾燥地における形態別抽出法を用いた土壌有機物中のカルシウム複合体の性質 Characterization of soil organic matter associated with calcium isolated by chemical fractionation in semi-arid land	

研究分担者 Co-researchers	神田 隆志 (筑波大学生命環境科学研究科) 井下 太貴 (筑波大学生命環境学群) 宮下 央章 (筑波大学生命環境科学研究科) Kanda, Takashi (Graduate school of Life and Environmental Sciences, University of Tsukuba) Inoshita, Taiki (School of Life and Environmental Sciences, University of Tsukuba) Miyashita, Nakaaki (Graduate school of Life and Environmental Sciences, University of Tsukuba)	
一般研究 21 (G 21) General Research 21 (G 21)	対応教員 Corresponding Staff:	安 萍 An, Ping
研究代表者 Principal Researchers	杉本 幸裕 (神戸大学大学院農学研究科) Yukihiro, Sugimoto (Graduate School of Agricultural Science, Kobe University)	
研究課題 Research Subject	半乾燥地の主要作物と根寄生雑草の寄生関係成立要因に関する生理生化学的研究 Physiological and biochemical analyses of interactions between host and parasitic plants	
研究分担者 Co-researchers	水谷 正治 (神戸大学大学院農学研究科) 吉本 千壽 (神戸大学大学院農学研究科) 上野 琴巳 (神戸大学大学院農学研究科) 野村 早紀 (神戸大学大学院農学研究科) Mizutani, Masaharu (Graduate School of Agricultural Science, Kobe University) Yoshimoto, Chizu (Graduate School of Agricultural Science, Kobe University) Ueno, Kotomi (Graduate School of Agricultural Science, Kobe University) Nomura, Saki (Graduate School of Agricultural Science, Kobe University)	
一般研究 22 (G 22) General Research 22 (G 22)	対応教員 Corresponding Staff:	安 萍 An, Ping
研究代表者 Principal Researchers	松浦 朝奈 (東海大学農学部) Matsuura, Asana (School of Agriculture, Tokai University)	
研究課題 Research Subject	中国黄土高原における雑穀の収量性と雑穀の複合環境ストレス耐性機構の解析 Mechanisms of tolerance to combined environmental stress of millets and grain yield of millets in Loess Plateau of China	
研究分担者 Co-researchers	村田 浩平 (東海大学農学部) Murata, Kouhei (School of Agriculture, Tokai University)	
一般研究 23 (G 23) General Research 23 (G 23)	対応教員 Corresponding Staff:	安 萍 An, Ping
研究代表者 Principal Researchers	阿部 淳 (東京大学大学院農学生命科学研究科) Abe, Jun (Graduate School of Agricultural and Life Sciences, The University of Tokyo)	
研究課題 Research Subject	ヤトロファ (Jatropha curcas) の根の形態学的特性と環境応答に関する研究 Study on morphological structure and environmental responses of roots in Jatropha curcas	
一般研究 24 (G 24) General Research 24 (G 24)	対応教員 Corresponding Staff:	安 萍 An, Ping
研究代表者 Principal Researchers	柏木 純一 (北海道大学農学研究院生物資源生産学部門) Kashiwagi, Junichi (Graduate School of Agriculture, Hokkaido University)	
研究課題 Research Subject	コムギの乾燥抵抗性改善のための乾燥回避性形質の特定 Identifying relevant drought avoidance traits to improve the wheat productivity under drought environments	
研究分担者 Co-researchers	三島 悠輔 (北海道大学大学院農学研究院) Mishima, Yusuke (Graduate School of Agriculture, Hokkaido University)	
一般研究 25 (G 25) General Research 25 (G 25)	対応教員 Corresponding Staff:	安 萍 An, Ping
研究代表者 Principal Researchers	松添 直隆 (熊本県立大学環境共生学部) Matsuzoe, Naotaka (Faculty of Environmental & Symbiotic Sciences, Prefectural University of Kumamoto)	
研究課題 Research Subject	底面給水型水耕栽培装置を用いた作物の蒸発散モデル構築に関する研究 Modeling of crop evapotranspiration used the closed hydroponics system with capillary uptake method	

研究分担者 Co-researchers	圖師 一文 (尚絅大学短期大学) 近藤 謙介 (鳥取大学農学部) 和島 孝浩 (熊本県立大学環境共生学部) 中嶋 康博 (熊本県立技術短期大学校情報通信技術科) Zushi, Kazufumi (Junior College, Shokei University) Kondo, Kensuke (Faculty of Agriculture, Tottori University) Wajima, Takahiro (Faculty of Environmental and symbiotic Sciences, Prefectural University of Kumamoto) Nakashima, Yasuhiro (Computer Network Engineering, Kumamoto Prefectural College of Technology)	
一般研究 26 (G 26) General Research 26 (G 26)	対応教員 Corresponding Staff:	安 萍 An, Ping
研究代表者 Principal Researchers	岡元 英樹 (北海道立総合研究機構上川農業試験場天北支場) Okamoto, Hideki (Tenpoku Branch, Kamikawa Agricultural Experiment Station, Hokkaido Research Organization)	
研究課題 Research Subject	寒地型牧草の根系発達に対する土壌水分の影響に関する研究 Study on effect of soil moisture on root system development of temperate grasses	
研究分担者 Co-researchers	笹木 正志 (北海道立総合研究機構上川農業試験場天北支場) 松原 哲也 (北海道立総合研究機構上川農業試験場天北支場) Sasaki, Masashi (Tenpoku Branch, Kamikawa Agricultural Experiment Station, Hokkaido Research Organization) Matsubara, Tetsuya (Tenpoku Branch, Kamikawa Agricultural Experiment Station, Hokkaido Research Organization)	
一般研究 27 (G 27) General Research 27 (G 27)	対応教員 Corresponding Staff:	安 萍 An, Ping
研究代表者 Principal Researchers	岡 真理子 (鳥取大学農学部) Oka, Mariko (Faculty of Agriculture, Tottori University)	
研究課題 Research Subject	高等植物の低窒素ストレス応答における植物ホルモンの役割 Hormonal regulation of responses to low nitrogen stress in higher plants	
研究分担者 Co-researchers	川上 翔 (鳥取大学大学院農学研究科) Kawakami, Sho (Grad. School of Agriculture, Tottori University)	
一般研究 28 (G 28) General Research 28 (G 28)	対応教員 Corresponding Staff:	安 萍 An, Ping
研究代表者 Principal Researchers	本間 知夫 (前橋工科大学工学部生物工学科) Homma, Tomoo (Department of Biotechnology, Maebashi Institute of Technology)	
研究課題 Research Subject	マングローブ植物根系の耐塩性機構の解剖生理学的解析 Anatomical and physiological analysis of salt tolerance in mangrove roots	
研究分担者 Co-researchers	地下 まゆみ (大阪大谷大学教育学部) Jige, Mayumi (School of Education, Osaka Ohtani University)	
一般研究 29 (G 29) General Research 29 (G 29)	対応教員 Corresponding Staff:	安 萍 An, Ping
研究代表者 Principal Researchers	清水 英幸 (国立環境研究所地域環境研究センター) Shimizu, Hideyuki (Center for Regional Environmental Research, National Institute for Environmental Studies)	
研究課題 Research Subject	半乾燥草原植物の乾燥耐性と水利用特性の種間差に関する研究 Researches on species difference on drought resistance and water use characteristics of plants in semiarid grassland	
研究分担者 Co-researchers	小林 祥子 (国立環境研究所地域環境研究センター) Kobayashi, Shoko (Center for Regional Environmental Research, National Institute for Environmental Studies)	
一般研究 30 (G 30) General Research 30 (G 30)	対応教員 Corresponding Staff:	坪 充 Tsubo, Mitsuru
研究代表者 Principal Researchers	原 隆一 (大東文化大学国際関係学部) Hara, Ryuich (Faculty of International Relations, Daito Bunka University)	

研究課題 Research Subject	西アジア乾燥地域における伝統的水利用技術と農村開発 The Utilization of Indigenous Technology for Water and Rural Socio-Economic Development in West Asia	
一般研究 31 (G 31) General Research 31 (G 31)	対応教員 Corresponding Staff:	坪 充 Tsubo, Mitsuru
研究代表者 Principal Researchers	西原 英治 (鳥取大学農学部) Nishihara, Eiji (Faculty of Agriculture, Tottori University)	
研究課題 Research Subject	木本類および作物における Hydraulic redistribution の評価—干ばつに対応した Intercropping システムでの最適な作物の候補— Magnitude of Hydraulic redistribution in woody and crop plants —promising candidates for suitable crops in an intercropping system under water stress—	
研究分担者 Co-researchers	柴田 昇平 (近畿中国四国農業研究センター傾斜地園芸研究領域) 星 典宏 (近畿中国四国農業研究センターカンキツブランド化プロジェクト) Shibata, Shouhei (Hillside Horticulture Research Division, NARO Western Region Agricultural Research Center) Hoshi, Norihiro (Profitable Citrus Production Project, NARO Western Region Agricultural Research Center)	
一般研究 32 (G 32) General Research 32 (G 32)	対応教員 Corresponding Staff:	山中 典和 Yamanaka, Norikazu
研究代表者 Principal Researchers	館野 隆之輔 (京都大学 フィールド科学教育研究センター) Tateno, Ryunosuke (Field Science Research and Education Center, Kyoto University)	
研究課題 Research Subject	中国黄土高原におけるニセアカシアとリョウトウナラ林における水利用効率の長期変動 Long term changes in water use efficiency of Quercus liaotungensis and Robinia pseudoacacia on Loess Plateau, China	
研究分担者 Co-researchers	杜 盛 (中国科学院水土保持研究所) Du Sheng (Institute of Soil and Water Conservation, Chinese Academy of Sciences)	
一般研究 33 (G 33) General Research 33 (G 33)	対応教員 Corresponding Staff:	山中 典和 Yamanaka, Norikazu
研究代表者 Principal Researchers	板井 章浩 (鳥取大学農学部) Itai, Akihiro (Faculty of Agriculture, Tottori University)	
研究課題 Research Subject	ナシの乾燥ストレス応答における適合溶質の役割 The role of compatible solutes in response to drought stress in Pyrus	
一般研究 34 (G 34) General Research 34 (G 34)	対応教員 Corresponding Staff:	山中 典和 Yamanaka, Norikazu
研究代表者 Principal Researchers	縄田 浩志 (総合地球環境学研究所研究部) Nawata, Hiroshi (Research Institute for Humanity and Nature Research Department)	
研究課題 Research Subject	中国黄土高原におけるニセアカシアとリョウトウナラ林における水利用効率の長期変動 Long term changes in water use efficiency of Quercus liaotungensis and Robinia pseudoacacia on Loess Plateau, China	
研究分担者 Co-researchers	杜 盛 (中国科学院水土保持研究所) Du Sheng (Institute of Soil and Water Conservation, Chinese Academy of Sciences)	
一般研究 35 (G 35) General Research 35 (G 35)	対応教員 Corresponding Staff:	山中 典和 Yamanaka, Norikazu
研究代表者 Principal Researchers	岩瀬 剛二 (帝京科学大学生命環境学部自然環境科学科) Iwase, Koji (Department of Natural and Environmental Science, Faculty of Life and Environmental Sciences, Teikyo University of Science)	
研究課題 Research Subject	タイ乾燥地に生育する Dipterocarpus alatus に対する土壌中の特異的菌根形成能力保有菌の特定 Determination of mycorrhizal fungi in the soils to form mycorrhizas to the seedlings of Dipterocarpus alatus growing in the dry area in Thailand	

研究分担者 Co-researchers	児玉 基一郎 (鳥取大学農学部) Kaewgrajang Tharnrat (鳥取大学連合農学研究科) Eiadthong Wichan (カセサート大学林学部) Sangwanit Uthaiwan (カセサート大学林学部) Kodama, Motoichiro (Faculty of Agriculture, Tottori University) Kaewgrajang, Tharnrat (United Graduate School, Tottori University) Eiadthong, Wichan (Faculty of Forestry Kasetsart University) Sangwanit, Uthaiwan (Faculty of Forestry, Kasetsart University)	
一般研究 36 (G 36) General Research 36 (G 36)	対応教員 Corresponding Staff:	山中 典和 Yamanaka, Norikazu
研究代表者 Principal Researchers	三木 直子 (岡山大学大学院環境学研究科) Miki, Naoko (Graduate School of Environmental and Life Science, Okayama University)	
研究課題 Research Subject	中国半乾燥地の木本植物 7 種の通水特性について Hydraulic architecture of seven woody species in semi-arid area, China	
研究分担者 Co-researchers	吉川 賢 (岡山大学環境学研究科) 楊 靈麗 (岡山大学) 西谷 征也 (岡山大学農学部) 津田 智和 (岡山大学農学部) Yoshikawa, Ken (Graduate School of Environmental Science, Okayama University) Yang, Lingli (Okayama University) Nishitani, Seiya (Faculty of Agriculture, Okayama University) Tsuda, Tomokazu (Faculty of Agriculture, Okayama University)	
一般研究 37 (G 37) General Research 37 (G 37)	対応教員 Corresponding Staff:	山中 典和 Yamanaka, Norikazu
研究代表者 Principal Researchers	長田 和雄 (名古屋大学大学院環境学研究科) Osada, Kazuo (Graduate School of Environmental Studies, Nagoya University)	
研究課題 Research Subject	日本における黄砂の沈着量の観測 Observation of mineral dust deposition flux in Japan	
研究分担者 Co-researchers	谷口 武士 (鳥取大学乾燥地研究センター) 黒崎 泰典 (鳥取大学乾燥地研究センター) 篠田 雅人 (鳥取大学乾燥地研究センター) Taniguchi, Takeshi (Arid Land Research Center, Tottori University) Kurosaki, Yasunori (Arid Land Research Center, Tottori University) Shinoda, Masato (Arid Land Research Center, Tottori University)	
一般研究 38 (G 38) General Research 38 (G 38)	対応教員 Corresponding Staff:	山中 典和 Yamanaka, Norikazu
研究代表者 Principal Researchers	松尾 奈緒子 (三重大学大学院生物資源学研究科) Matsuo, Naoko (Graduate School of Bioresources, Mie University)	
研究課題 Research Subject	安定同位体比を用いた土壌塩類集積地における塩生植物と土壌間の窒素循環の解明 Nitrogen cycle between halophytes and soil in a salt-accumulated desert determined by stable isotope analysis	
研究分担者 Co-researchers	小瀬 雄太 (三重大学生物資源学部) 尾坂 兼一 (滋賀県立大学環境科学部) Kose, Yuta (Faculty of Bioresources, Mie University) Osaka, Kenichi (School of Environmental Science, The University of Shiga Prefecture)	
一般研究 39 (G 39) General Research 39 (G 39)	対応教員 Corresponding Staff:	山中 典和 Yamanaka, Norikazu
研究代表者 Principal Researchers	大槻 恭一 (九州大学東アジア環境研究機構) Otsuki, Kyoichi (Research Institute for East Asia Environment, Kyushu University)	
研究課題 Research Subject	中国寧夏回族自治区固原を拠点とした日中韓共同砂漠化防止研究の展開 Development of the Japan-China-Korea Joint Research for Combating Desertification based in Guyuan, Ningxia Hui Autonomous Region in China	
研究分担者 Co-researchers	北野 雅治 (九州大学農学研究院) 馬 永清 (水土保持研究所) 全 權雨 (江原大学校山林環境科学大学) Kitano, Masaharu (Faculty of Agriculture, Kyushu University) Ma, Yongqing (Institute of Soil & Water Conservation) Chun, Kunwoo (College of Forest & Environmental Sciences, Kangwon National University)	

一般研究 40 (G 40) General Research 40 (G 40)		対応教員 Corresponding Staff:	山中 典和 Yamanaka, Norikazu
研究代表者 Principal Researchers	岩間 憲治 (滋賀県立大学環境科学部) Iwama, Kenji (School of Environmental Science, The University of Shiga Prefecture)		
研究課題 Research Subject	Tamarix を用いた塩類集積土壌の改善技術の開発 The development of remediation technology for the saline soil using Tamarix		
研究分担者 Co-researchers	筧 英晃 (滋賀県立大学環境科学研究科) 加藤 典子 (滋賀県立大学環境科学部) Yano, Hideaki (Environmental Science Graduate School, The University of Shiga Prefecture) Kato, Noriko (School of Environmental Science, The University of Shiga Prefecture)		
一般研究 41 (G 41) General Research 41 (G 41)		対応教員 Corresponding Staff:	山中 典和 Yamanaka, Norikazu
研究代表者 Principal Researchers	谷口 真吾 (琉球大学農学部亜熱帯農林環境科学科) Taniguchi, Shingo (Faculty of Agriculture, University of the Ryukyus)		
研究課題 Research Subject	マングローブ植物における耐塩機構 Salt tolerance mechanism in mangrove plants		
研究分担者 Co-researchers	宮田 慎吾 (琉球大学農学部) 川田 慎太郎 (琉球大学農学部) Miyata, Shingo (Faculty of Agriculture, University of the Ryukyus) Kawada, Shintaro (Faculty of Agriculture, University of the Ryukyus)		
一般研究 42 (G 42) General Research 42 (G 42)		対応教員 Corresponding Staff:	山中 典和 Yamanaka, Norikazu
研究代表者 Principal Researchers	山本 福壽 (鳥取大学農学部) Yamamoto, Fukuju (Faculty of Agriculture, Tottori University)		
研究課題 Research Subject	中国乾燥地の移動砂丘固定に用いられる小葉楊 (Populus simonii) の乾燥地適応と繁殖戦略、および植栽技術開発に関する研究 Studies on stress adaptability, reproductive strategy and reforestation technology of Populus simonii for sand dune fixation in Kubuchi desert, China		
一般研究 43 (G 43) General Research 43 (G 43)		対応教員 Corresponding Staff:	藤巻 晴行 Fujimaki, Haruyuki
研究代表者 Principal Researchers	森井 俊広 (新潟大学農学部) Morii, Toshihiro (Faculty of Agriculture, Niigata University)		
研究課題 Research Subject	土のキャピラリーバリアを利用した根群域の保水性向上と地下水からの塩水侵入阻止に関する研究 Enhancement of Soil Water Retention Capacity in Plant Root Zone and Interception of Upward Saline Water from Groundwater by Using Capillary Barrier of Soil		
研究分担者 Co-researchers			
一般研究 44 (G 44) General Research 44 (G 44)		対応教員 Corresponding Staff:	藤巻 晴行 Fujimaki, Haruyuki
研究代表者 Principal Researchers	東 照雄 (筑波大学大学院生命環境科学研究科) Higashi, Teruo (Graduate School of Life and Environmental Science, University of Tsukuba)		
研究課題 Research Subject	乾燥地における灌漑農業による土壌環境評価 The evaluation on soil environment affected by irrigation at arid land		
研究分担者 Co-researchers	八下田 佳恵 (筑波大学大学院生命環境科学研究科) 小林 諒 (筑波大学生命環境科学研究科) Yageta, Yoshie (Graduate School of Life and Environmental Science, University of Tsukuba) Kobayashi, Ryo (Graduate School of Life and Environmental Science, University of Tsukuba)		
一般研究 45 (G 45) General Research 45 (G 45)		対応教員 Corresponding Staff:	藤巻 晴行 Fujimaki, Haruyuki

研究代表者 Principal Researchers	長 裕幸 (佐賀大学農学部) Cho, Hiroyuki (Faculty of Agriculture, Saga University)	
研究課題 Research Subject	TDR 大型多線式プローブによる面的土壌水分・塩分測定法の開発と圃場への応用 Two dimensional measurement of water content and salinity in surface area through TDR with multi-long lods	
研究分担者 Co-researchers	宮本 英揮 (佐賀大学農学部) Miyamoto, Hideki (Faculty of Agriculture, Saga University)	
一般研究 46 (G 46) General Research 46 (G 46)	対応教員 Corresponding Staff:	藤巻 晴行 Fujimaki, Haruyuki
研究代表者 Principal Researchers	竹内 真一 (南九州大学環境園芸学部) Takeuchi, Shinichi (Faculty of Environmental Horticulture, Minami Kyushu University)	
研究課題 Research Subject	燃料作物の消費水量の算定と環状剥皮による根の更新の検討 Evaluation of water requirement for fuel crop and the renewal of root system by girdling.	
一般研究 47 (G 47) General Research 47 (G 47)	対応教員 Corresponding Staff:	藤巻 晴行 Fujimaki, Haruyuki
研究代表者 Principal Researchers	猪迫 耕二 (鳥取大学農学部) Inosako, Koji (Faculty of Agriculture, Tottori University)	
研究課題 Research Subject	キャピラリーバリア存在下でのリーチングによる除塩の可能性と限界について Possibility and limitation of desalinization by leaching under the condition of existence of a capillary barrier.	
一般研究 48 (G 48) General Research 48 (G 48)	対応教員 Corresponding Staff:	藤巻 晴行 Fujimaki, Haruyuki
研究代表者 Principal Researchers	黒田 清一郎 (農業食品産業総合研究機構農村工学研究所) Kuroda, Seiichiro (National Institute for Rural Engineering, NARO)	
研究課題 Research Subject	乾燥地深層地盤における水分塩分挙動観測技術の開発 Development for monitoring technique of soil water and solute transport in deep vadose zone in arid land area	
一般研究 49 (G 49) General Research 49 (G 49)	対応教員 Corresponding Staff:	藤巻 晴行 Fujimaki, Haruyuki
研究代表者 Principal Researchers	斎藤 広隆 (東京農工大学大学院農学研究院) Saito, Hirotaka (Institute of Agriculture, Tokyo University of Agriculture and Technology)	
研究課題 Research Subject	温度勾配下の土中水蒸気移動を利用した節水灌漑に関する研究 Micro-irrigation based upon vapor transport in soils under temperature gradient	
研究分担者 Co-researchers	大塚 真希 (東京農工大学大学院農学府) Otsuka, Maki (Graduate School of Agriculture, Tokyo University of Agriculture and Technology)	
一般研究 50 (G 50) General Research 50 (G 50)	対応教員 Corresponding Staff:	伊藤 健彦 Ito, Takehiko
研究代表者 Principal Researchers	辻 大和 (京都大学霊長類研究所) Tsuji, Yamato (Primate Research Institute, Kyoto University)	
研究課題 Research Subject	乾燥地および寒冷地に生息する野生霊長類の各種行動形質と生息環境との関連性 Relationships between behavioral traits of wild primates inhabiting dry and cool regions and their habitat en- vironments	
一般研究 51 (G 51) General Research 51 (G 51)	対応教員 Corresponding Staff:	谷口 武士 Taniguchi, Takeshi

研究代表者 Principal Researchers	山中 高史 (森林総合研究所森林微生物研究領域) Yamanaka, Takashi (Forest Microbiology Division, FFPRI)
研究課題 Research Subject	菌根菌ネットワークによる塩類ストレス下における樹木間養分転送機構の解明 Mechanisms of nutrient transfer among trees via mycorrhizal network under high salinity conditions
研究分担者 Co-researchers	竹内 祐子 (京都大学農学研究科) Takeuchi, Yuko (Graduate School of Agriculture, Kyoto University)

3) 若手奨励研究 / Incentive Research by Young Scientists

若手奨励研究 1 (Y 1) Incentive Research by Young Scientists 1 (Y 1)	対応教員 Corresponding Staff:	安田 裕 Yasuda, Hiroshi
研究代表者 Principal Researchers	齊藤 忠臣 (鳥取大学農学部) Saito, Tadaomi (Faculty of Agriculture, Tottori University)	
研究課題 Research Subject	樹体内水分モニタリングと水の安定同位体分析を用いた乾燥地樹木の水利利用戦略解明 Clarification of water use strategy of trees in arid lands based on tree water monitoring and water stable isotope ratio analysis	
若手奨励研究 2 (Y 2) Incentive Research by Young Scientists 2 (Y 2)	対応教員 Corresponding Staff:	安 萍 An, Ping
研究代表者 Principal Researchers	近藤 謙介 (鳥取大学農学部) Kondo, Kensuke (Faculty of Agriculture, Tottori University)	
研究課題 Research Subject	蔬菜の養液栽培における塩水の利用 Utilization of saline water in soilless culture system for growing vegetables	
若手奨励研究 3 (Y 3) Incentive Research by Young Scientists 3 (Y 3)	対応教員 Corresponding Staff:	山中 典和 Yamanaka, Norikazu
研究代表者 Principal Researchers	宮沢 良行 (九州大学東アジア環境研究機構) Miyazawa, Yoshiyuki (Institute for East Asia Environments, Kyushu University)	
研究課題 Research Subject	降水量に沿ったニセアカシアの水利利用の推移様式の解明 Analysis of geographical trend in transpiration by Robinia pseudoacacia plantation along precipitation gradient	
若手奨励研究 4 (Y 4) Incentive Research by Young Scientists 4 (Y 4)	対応教員 Corresponding Staff:	山中 典和 Yamanaka, Norikazu
研究代表者 Principal Researchers	衣笠 利彦 (鳥取大学農学部) Kinugasa, Toshihiko (Faculty of Agriculture, Tottori University)	
研究課題 Research Subject	モンゴル草原における低嗜好性雑草 <i>Artemisia adamsii</i> の定着と拡大 Establishment and expansion of a low palatable weed, <i>Artemisia adamsii</i> , in the Mongolian steppe	
若手奨励研究 5 (Y 5) Incentive Research by Young Scientists 5 (Y 5)	対応教員 Corresponding Staff:	藤巻 晴行 Fujimaki, Haruyuki
研究代表者 Principal Researchers	小林 幹佳 (筑波大学生命環境系) Kobayashi, Motoyoshi (Faculty of Life and Environmental Sciences, University of Tsukuba)	
研究課題 Research Subject	土壌コロイドの界面化学特性に基づく土壌改良剤の侵食抑制機能の解明 Elucidation of the control mechanism of soil erosion by soil conditioners on the basis of colloidal properties of soil particles	
若手奨励研究 6 (Y 6) Incentive Research by Young Scientists 6 (Y 6)	対応教員 Corresponding Staff:	藤巻 晴行 Fujimaki, Haruyuki
研究代表者 Principal Researchers	森谷 慈宙 (弘前大学農学生命科学部) Moritani, Shigeoki (Language Studies and International Center, Hirosaki University)	

研究課題 Research Subject	写真測量によるリル侵食メカニズムの解明 Study on mechanism of rill erosion using photogrammetry
-----------------------------	--

若手奨励研究 7 (Y 7) Incentive Research by Young Scientists 7 (Y 7)	対応教員 Corresponding Staff:	伊藤 健彦 Ito, Takehiko
研究代表者 Principal Researchers	吉原 佑 (東北大学農学部) Yoshihara, Yu (Graduate School of Agricultural Science, Tohoku University)	
研究課題 Research Subject	過放牧による飼料中ミネラルバランスの劣化がモンゴルの家畜の健康性に及ぼす影響 Effect of dietary mineral imbalance due to overgrazing on Mongolian livestock health	

若手奨励研究 8 (Y 8) Incentive Research by Young Scientists 8 (Y 8)	対応教員 Corresponding Staff:	谷口 武士 Taniguchi, Takeshi
研究代表者 Principal Researchers	片岡 良太 (山梨大学生命環境学部環境科学科) Kataoka, Ryota (Faculty of Life and Environmental Sciences, Yamanashi University)	
研究課題 Research Subject	バイオフィーム形成細菌による塩類集積土壌での植物根の保護 Protection of plant root by using biofilm producing bacteria in the salt accumulation soil	

4) 研究会 / Research Meeting

研究会 1 (M 1) Research Meeting 1 (M 1)	対応教員 Corresponding Staff:	恒川 篤史 Tsunekawa, Atsushi
研究代表者 Principal Researchers	福井 希一 (大阪大学工学研究科) Fukui, Kiichi (Graduate School of Engineering, Osaka University)	
研究課題 Research Subject	ジャトロファ研究会 Jatropha Workshop	
研究分担者 Co-researchers	土本 卓 (大阪大学工学研究科) 湯浅 彰太 (大阪大学工学研究科) 辻 渉 (鳥取大学農学部) 留森 寿士 (鳥取大学乾燥地研究センター) 万代 文子 (大阪大学工学研究科) 安藤 孝之 (鳥取大学乾燥地研究センター) 酒井 啓江 (大阪大学工学研究科) 笹井 知博 (大阪大学工学研究科) 辻本 壽 (鳥取大学乾燥地研究センター) Tsuchimoto, Suguru (Graduate School of Engineering, Osaka University) Yuasa, Syota (Graduate School of Engineering, Osaka University) Tsuji, Wataru (Faculty of Agriculture, Tottori University) Tomemori, Hisashi (Arid Land Research Center, Tottori University) Mandai, Ayako (Graduate School of Engineering, Osaka University) Ando, Takayuki (Arid Land Research Center, Tottori University) Sakai, Hiroe (Graduate School of Engineering, Osaka University) Sasai, Chihiro (Graduate School of Engineering, Osaka University) Tsujimoto, Hisashi (Arid Land Research Center, Tottori University)	

研究会 1 (M 1) Research Meeting 1 (M 1)	対応教員 Corresponding Staff:	恒川 篤史 Tsunekawa, Atsushi
研究代表者 Principal Researchers	大槻 恭一 (九州大学東アジア環境研究機構) Otsuki, Kyoichi (Research Institute for East Asia Environment, Kyushu University)	
研究課題 Research Subject	乾燥地における森林と水の関わり Forest and Water in Arid Lands	
研究分担者 Co-researchers	笠原 玉青 (九州大学農学研究院) Kasahara, Tamao (Faculty of Agriculture, Kyushu University)	

(2) 共同研究要旨 / Summary of Joint Research

F 1	<p>砂漠緑化のための太陽光・風力併用発電を用いた海水揚水・灌漑水生成システムの実証試験 Field test of seawater pumping and irrigation water making system using solar and wind power for greening the desert</p> <p>This study aims to develop the crop cultivation system with the conservation of environment and resources in dry land. The developing system is composed of solar and wind power generation, pump system, desalination device and saving water irrigation.</p> <p>Therefore, the field experiment of the prototype system was carried out at the coastal sand dune of Arid Land Research Center of Tottori University from July 18 th to August 31 th, 2012. In the experiment, coastal ground water (EC=0.4 dS/m) was pumped up from the well to the water storage tank located on the hill of 30 m above sea level through the water piping. Two DC pumps installed at the each point of different altitude were used in the system. The length of water piping was about 350 m. Then, the storage ground water was supplied to the greenhouse in order to irrigate for the cultivation of tomato, using the gravity caused by the difference of the altitude between the tank and greenhouse. The electric power generated from the photovoltaic module, the electric consumption needed to operate the pump, and the flow rate and the concentration of ground water were measured in the experiment. The results of the experiments were as follows:</p> <p>(1) The flow rate of pumped ground water and electric power consumption per pump were 5.0 l/min and 60 W approximately when the pump was operated for 15 minutes. The power generation of photovoltaic module was about two times larger than the power consumption of the pump in daytime (10:00-15:00). It was found that the ratio of the amount of electric power consumption per day for pumping the ground water was 60% for the total amount of power generation of photovoltaic module per day.</p> <p>The total amount of pumped ground water was 4,000 l approximately for the practical operating time of about 800 minutes in the period of experiment.</p> <p>(2) The amount of irrigation water per day supplied for the cultivation was approximately set to 80 l per irrigated area of 30 m². It was found that 63% of total amount of pumped ground water was practically irrigated for 29 days in this case.</p> <p>(3) Based on the experimental results, it was possible to predict the operation scheduling of the pumping system response to the irrigation scheduling for the crop cultivation.</p>	<p>田川 公太郎 Tagawa, Kotaro</p>
F 2	<p>悪環境下におけるジャトロファ花成・登熟および代謝調節技術によるバイオ燃料生産強化のシステム開発 A systematic approach for the fortification of biodiesel production via engineering of flowering, fruit maturation and metabolic control in Jatropha under adverse environmental conditions</p> <p>Jatropha produces oil-rich seeds and is relatively drought-resistant, and thus has been proposed as the biofuel crop in the arid zones. In this study, patterns of biomass accumulation and gene expression profile during Jatropha fruit maturation were comprehensively analyzed by transcriptome and metabolome analyses. In collaboration with Prof Suharsono in Bogor Agricultural University of Indonesia, change in the biomass composition of Jatropha fruit was examined from flowering to maturation. Consequently, major ingredient in the developing fruit changed from starch to glucose and sucrose, and then massive accumulation of triacylglycerol was observed at the final stage of maturation, suggesting the presence of dynamic metabolic regulation during fruit maturation in Jatropha. Analysis of gene expression profile by next-generation sequencing revealed that various metabolic pathways were independently up-regulated or down-regulated by time-dependent manners. In particular, genes for fatty acid biosynthesis were strongly up-regulated at the final stage of maturation, suggesting that oil biosynthesis is transcriptionally regulated in Jatropha seeds. Moreover, several transcriptional regulators were found to be up-regulated during fruit maturation, indicating that some of these factors may function as regulators of specific metabolic pathway. To facilitate data mining, omics visualization systems were constructed by MAPMAN and Kappa View platforms. This system will be applicable to future analysis on Jatropha molecular biology, including environmental responses and genotype differences.</p>	<p>明石 欣也 Akashi, Kinya</p>
F 3	<p>環境ストレス耐性向上のための形質転換植物の作製及び DNA マーカーを用いた在来・野生系統の選抜と環境再現装置を用いた耐環境ストレス能の評価 Production of genetically-engineered plants and selection of native or wild lines for improvement of the stress tolerance, and evaluation of the tolerance by using environment simulators</p> <p>First, we newly identified and isolated the JcNF-YB 6 gene from jatropha. It is the jatropha ortholog of Arabidopsis AtNF-YB 1, which is involved in drought tolerance and oil yield. Because the previously-identified JcNF-YB 6 sequence was not complete, we searched the jatropha database again, and determined the complete sequence. We detected its expression in leaves by RT-PCR.</p> <p>Next, to examine drought tolerance of transformants, we brought 8 lines (22 plants) of GM jatropha overexpressing the AtPPAT gene, one line (3 plants) of GM jatropha overexpressing the AtNF-YB 1 gene, and 4 non-GM plants to Arid Land Research from Osaka University, transplanted in 1/5000 Wagner pots with sand, and placed in a sub-tropical desert simulator (30°C, 12/12 h (day/night)). Plants were grown for a month with light intensity raising gradually until it reached 120,000 lux. Pots were then sealed and stopped watering for two weeks for the drought treatment. Dur-</p>	<p>福井 希一 Fukui, Kiichi</p>

	<p>ing the treatment, photosynthetic rate, stomatal conductance, and electron transport rate of the uppermost expanded leaves were measured. Plants were watered after the treatment, and grown for a month for recovery, and examined in a similar way. We found that GM plants overexpressing either of the transgenes showed significantly higher photosynthetic rate, stomatal conductance, and electron transport rate than non-GM plants. These results indicate that drought tolerance was improved in both of the transformants.</p> <p>Finally, we produced 60 SSR markers which showed polymorphisms among Mexican jatropha lines, and finished typing of 219 samples from the INIFAP collection using the markers. We also did association analysis of 113 lines from the collection using the marker data and the agronomic data, and identified markers which were associated to the high yield trait.</p>	
F 4	<p>中国の西部乾燥地域における鉱山資源開発と植生回復政策の執行過程における仕組みと現状に関する研究—内モンゴル自治区烏海市を事例に— A study on the enforcement process and the mechanism, current state of mineral resources development and vegetation recovery policy in arid areas of western China</p> <p>Through the case study in Wuhai city, we found that the degree of political importance to the problem destruction of vegetation is greatly improved, and a trend that appears as a feature of public expenditure of central government and local government finance. Because of the physical nature of Wuhai city that it is located in the desert, the prevention and control of desertification is positioned as a welfare improvement strategy, and in the budget for greening has been significant increased. At the same time, the problems of intensive water resources and the technical problems have been closed up because of the greening in arid regions.</p>	<p>金 紅実 Jin, Hongshi</p>
G 1	<p>気候傾度に沿ったカザフスタン—モンゴルステップトランセクトにおける草原生態系変動 Grassland dynamics in relation to climatic gradients in trans-steppe transect from Kazakhstan to Mongolia.</p> <p>Integrated observation on meteorological, soil and vegetation components have started at Kazakhstan-Mongolian grassland (1 station at Kazakhstan and 3 stations at Mongolia). We set up new meteorological observation system in October 2012 at Bulgan in eastern Mongolia. Some of the Mongolian stations were improved adding the ARGOS data transfer system and obtained data based on quasi realtime data acquisition was analyzed to exhibit the winter climate system in Kazakh-Mongolia steppe. According to the observed and reanalysis data, periodic intrusion of cold air mass after October occurred along with snow fall event in relation to cyclone activity preceding the cold air advection. The combination between snow fall and cold air formation effectively intensified ground freezing which is one of the unique processes to carry over the soil moisture anomaly as climatic memory in this region. In 2012, it was wet summer with high soil moisture content in central and eastern Mongolia, thus the soil moisture and temperature anomalies stored in this winter may expect to affect plant growth in the coming growing season.</p> <p>In addition, hydro-meteorological analyses at forest-steppe ecotone at Terelj in Mongolia were performed and published in the scientific journal. The estimation of water balance during summer demonstrated that the larch forest slope with underlying permafrost suppressed the evapotranspiration with half of amounts in grassland slope. It means that precipitation and soil water in forest slope can be partitioned to evapotranspiration and river runoff. On the other hand, grassland at south-facing slope with no underlying permafrost has remarkably large amounts of evapotranspiration and therefore both precipitation and soil water was consumed entirely to evapotranspiration. The results depicted that the coexistence between permafrost and forest in mountain slope has an important role in sustaining water resource.</p>	<p>飯島 慈裕 Iijima, Yoshihiro</p>
G 2	<p>モンゴルにおける水資源環境の長期的変動の復元 Long-term Monitoring of Water Resources in Mongolia</p> <p>The filed survey at Mongolia was done since August 26 through September 3, 2011. The member of the survey were Prof. Kaoru Kashima (Kyushu University), Mr. Yu Fukumoto (Kyushu University) and Mr. U. Ganzorig (Institute of Geography, Mongolian Academy of Sciences). Ms. A.Orkhonselenge (Kanazawa University) went to Mongolia before the survey to arrange the preparing for it. Prof. Yukiya Tanaka, Go Ahrum and Kim songHyong joined the field survey. The filed area of it is the Khuder Peat Land and river flood plain of Sergen River, north-central Mongolia We took the peat sediment using the drilling machine, and presumed the environmental changes by C 14 dating and micro-paleontological analyses. The drastic changes of climatic environment and water resources at 4000 years ago and 800 years ago at north Mongolia were clearly examined by the survey.</p>	<p>鹿島 薫 Kashima, Kaoru</p>
G 3	<p>乾燥地都市における経済開発とその特性—北米地域を事例として— Economic Development and its Character in Arid Land—A Case Study on Cities in North America—</p> <p>In order to examine this research project, we investigated the features of economic development in some metropolitan areas of Silicon Valley and Phoenix metropolitan area in Arizona State.</p> <p>In Silicon Valley, there was the agglomeration of ICT industries and it had the industrial structure which is suitable for the environment of arid land. On the other hand, Phoenix metropolitan area was characterized the functional differentiation between the central area and suburban areas. The central area was agglomerated by the industry of sightseeing and functions of research and development, while suburban areas had residential functions and welfare functions for senior citizens. The industrial structure of the central area of Phoenix was suitable for the environment of arid land</p>	<p>北川 博史 Kitagawa, Hirofumi</p>

	as well as Silicon Valley.	
G 4	<p>夏季モンゴルにおける低気圧・前線の構造と降水量変動に関する研究 A study of precipitation variation in relation to the structure of cyclones and fronts in summer Mongolia</p> <p>木村 圭司 Kimura, Keiji</p> <p>With the recent data, the structure of a front and a low pressure and their transformation are clarified about the inter-annual variability of the rainfall in summer Mongolia. Routes of low pressures and water vapor flux above Mongolia were mainly analyzed. As a result, more rainfall was observed in the northern/eastern part and less rainfall in the southern/western area. The trend is equivalent to vegetation. As typical cases, following four examples in August, 2000 were analyzed. From daily analysis of rainfall area, SLP, and 850 hPa water vapor flux, almost of the low pressures have a tendency to move from the west to the east, but the water vapor flux is bigger in the eastern area.</p> <p>1) Around 40 N, 105 E, on August 6 th, 2000: The low pressure moved eastwards above the southern Mongolia. The rainfall was distributed in the west side of the low pressure. The water vapor transportation flux was seen more at the previous day. Its direction changed from south-east to north-west after the low pressure passed over the area.</p> <p>2) Around 45 N, 111 E, on August 9 th, 2000: The low pressure moved north-eastward slowly. The high pressure in eastern part was declined as it moved eastward. The low pressure developed and a water vapor flux from the south-eastern area became remarkable. The precipitation reached up to 3 mm/day, and the water vapor flux in 850 hPa became large.</p> <p>3) Around 50 N, 95 E, on August 12 th and 13 th, 2000: The low pressure developed on August 14 th. It brought rainfall of 4 mm/day in north-eastern Mongolia after it moved there. However, the water vapor flux was not so big in the back side of the low pressure.</p> <p>4) Around 50 N, 105 E, on August 20 th, 2000: A low pressure was generated newly around this area. The maximum precipitation was 3 mm/day and it is not little. A water vapor flux from north-west was seen on August 20 th, and from north-east on the following day. The maximum of the water vapor flux was in the high altitude.</p>	
G 5	<p>アメリカ合衆国南西部における都市開発の多様性と小規模中心地の盛衰に関する研究 The diversity of urban developments and vicissitude of the small centers in the south-western part of USA</p> <p>山下 博樹 Yamashita, Hiroki</p> <p>I studied about the diversity of urban development of arid lands in the south-western part of USA. I visited to silicon valley in San Fransisco, Hoover Dam and Phenix metropolitan area on September.</p>	
G 6	<p>土壌の凍結・融解にともなう CO₂ 放出の測定 Soil CO₂ emission during freezing-thawing cycles</p> <p>中野 智子 Nakano, Tomoko</p> <p>The final goal of our study is to evaluate the annual CO₂ budget between the atmosphere and semiarid grassland ecosystems. We conducted field measurements of CO₂ fluxes in Mongolian steppe grassland during plant growing seasons from 2004 to 2011. In general, soil CO₂ emission in winter time is considered negligible. However, recent studies reported that some microbes can act in frozen soils and CO₂ could burst from soil surface during soil freezing-thawing cycles. It is important, as a next step, to clarify CO₂ emission from grassland soils in a non-growing season. In the present joint study, aiming to evaluate the amount of CO₂ emission from soils during freezing-thawing cycles and to examine controlling factors of the emission, we made CO₂ flux measurements from a soil sample in a laboratory. We froze the soil samples in a freezer and measured CO₂ emission from the sample every 3 hours during thawing at room temperature (about 20 degrees C). The results showed that CO₂ emission increased after the soil temperature exceeded 0 degrees C and the amount of CO₂ burst was larger for the wet soil samples than for the dry samples.</p>	
G 7	<p>北東アジア半乾燥地帯における黄砂発生メカニズムの機構解明に関する観測的研究 Observation on dust emission processes on semi-arid region in Northeastern Asia.</p> <p>三上 正男 Mikami, Masao</p> <p>In order to investigate dust emission processes, especially for understanding the relation among vegetation, soil moisture and meteorological condition with dust emission over semi-arid region, we have conducted a field observation at Bayan-Unjuul in Mongolia in 2012 Spring. For this purpose, dust monitoring system was settled on a bare soil surface and preliminary observation was made. The system consists of automatic weather station, sensors for soil moisture and soil temperature, dust particle counters (Dust Trak), sand particle counter, and ultrasonic anemometer. Preliminary results suggested that soil surface crust is an controlling factor for dust emission. We also discussed the development of band-pass method for evaluation of dust vertical flux for precise estimation of the flux.</p>	
G 8	<p>モンゴル草原地域における放牧圧の推定とその陸域生態系モデルへの導入 Estimating grazing pressure in Mongolian grasslands and its incorporation to a terrestrial ecosystem model</p> <p>立入 郁 Tachiiri, Kaoru</p> <p>Fist we checked the statistical data and found that the grazing pressure in Mongolia in sheep unit (SU, coefficients are 5, 7, 6, 1, 0.9 for camels, horses, cattle, sheep and goats) changed around 50–70 million SU in 1996–2011 with gradual increase in normal years alternating with rapid decrease in dzud years. This is equivalent to 0.29–0.46 SU/ha (0.34–0.54 SU/ha if the denominator is grassland area), and smaller than the number for Kherlenbayan-Ulaan in Chen et al. (2007, Journal of Hydrology). An aimag-based analysis showed the central region has a large grazing pressure (>0.65 SU/ha), while the south and east-end regions have small values (<0.4 SU/ha).</p>	

	<p>Next, following Chen et al. (2007), we added a new term to vegetation model Sim-CYCLE (Ito and Oikawa, 2002, Ecological Modelling) to consider the grazing pressure. The term daily removes the above-ground biomass (AGB) by $AGB * (\text{grazing pressure}) * (\text{grazing efficiency})$ with an upper limit. Using the modified Sim-CYCLE, we carried out an experiment forced by MIROC 3.2 output with SRES A1B scenario (similarly to Tachiiri and Shinoda, 2012, SOLA). After spinning up the model with zero grazing pressure for 1900, we input a constant and spatially uniform grazing pressure from 1901. Here, the same grazing efficiency as Chen et al. (2007) is used, and for grazing pressure in addition to the Chen et al.'s (2007) values (0.0, 0.4, 0.7, 1.0, 1.2 SU/ha), we used 0.1, 0.2, 0.3, 0.5, 0.6 SU/ha considering the above-mentioned values we got for Mongolia. The result shows that LAI halves with 0.1 SU/ha grazing pressure. LAI got equilibrated with a grazing pressure ≤ 1.0 (SU/ha), but shrank to zero for 1.2 (SU/ha). The significant increasing trend in LAI found with no grazing pressure became unremarkable when grazing pressures was considered.</p>	
G 9	<p>黄砂発生源における蒸発散量推定技術の適用評価について Evaluation of evapotranspiration estimation technique for yellow-dust monitoring</p> <p>This research focuses on a large-scale soil moisture estimation using satellite remote-sensing as a tool of monitoring water environment for yellow-dust production areas in arid and semi-arid lands. In this year, we re-evaluated the accuracy of soil moisture estimation via a surface temperature index (MTVDI), by the depth, using volumetric soil water content, land surface temperature and meteorological data measured at Shenmu, China. The results have published via an international journal regarding water management. As a second topic of research activity, the proposed model was partially applied to MODIS daily land surface temperature imagery of year 2001 for East Asia region, and surface evapotranspiration was estimated. Through the application experiment, the applicability of estimation model for a large amount of satellite data was confirmed. Also, the qualitative evaluation of the estimation results indicated the model represented the spatial distribution of soil moisture content very well. The results were presented in the research presentation meeting of the Arid Land Research Center.</p>	<p>多炭 雅博 Masahiro Tasumi</p>
G 10	<p>乾燥地エジプトの灌漑耕作システムの学際的研究 Multi-disciplinary study of irrigation and cultivation system of arid land, case of Egypt</p> <p>The symposium titled "The 4th Egyptian Japanese Joint Symposiums on "Remote Sensing and Its Application; From Archaeology to Social Sciences" was held on 11-12 September of 2012 in Cairo, Egypt in collaboration with National Authority for Remote Sensing and Space Sciences (NARSS) and in it, the following four presentations were made: 1) H. Kato and E. Iwasaki, "Rashda Village: Its History and Social Life", 2) E. Iwasaki and H. Kato, "Social Environment, Irrigation and Cultivation in Rashda Village", 3) R. Kimura, "Climatic features in Rashda village and detection of cultivation pattern and water use using satellite data", 4) S.F. Elbeih, E. Iwasaki and H. Kato, "Irrigation and Land Use in Rashda Village: Case Study of Well No. 3 District, Based on Satellite Data".</p>	<p>加藤 博 Kato, Hiroshi</p>
G 11	<p>エジプト西部砂漠のオアシスで行われている輪作体系に対する灌漑時期の最適化 Optimization of irrigation period for the crop rotation system in oasis of the Western Desert, Egypt</p> <p>Main objects of this research are 1) determining the parameters of the growth model for the crops from the meteorological data, grown in Rashda village which is located in the Dakhla oasis of the western desert in Egypt and 2) proposing the optimum crop rotation system with efficient irrigation.</p> <p>We are conducting the research of cropping season to maximize their yields under limited water supply in Rashda village since 2009. In Kato et al. (2010), we applied a model AquaCrop provided by FAO to the wheat grown there and discussed the relations between numbers and amounts of irrigation. In this research, we used the same method to paddy, alfalfa, maize beans and vegetables which has included in the traditional rotation system of the oasis in the western desert.</p> <p>The meteorological data which were used in the former study, were measured by Egyptian government at the distance more than 100 km away from the village and without reliability. We set the pyrhelimeter and thermometer at Mut near Rashda village and measured the data every 1 hour only in August and we concluded that the data measured by Egyptian government are accurate enough to be used in the model. Dr. Kato and Dr. Iwasaki who are co-researchers in this research surveyed main crop yields (wheat, corn, rice, alfalfa, broad beans, peas, okra and onion). We tuned parameters for AquaCrop to the reasonable values for the results. For wheat and corn, reasonable results were obtained but for rice, alfalfa and beans the model could not express the difference of the number of irrigation</p>	<p>松岡 延浩 Matsuoka, Nobuhiro</p>
G 12	<p>乾燥地における地下水と土壌環境に対する植生の影響 Effect of phreatophyte on groundwater and soil in arid environment</p> <p>A numerical one-dimensional reactive transport model for subsurface unsaturated-saturated flow and root water uptake was developed. The developed numerical model considered reactive transport, root water uptake, and unsaturated-saturated flow. Hydraulic conductivity, unsaturated flow parameters, and selectivity coefficients of cation exchange were obtained for the model. Drainage column tests were carried out to obtain water retention curve. The van Genuchten equation was used for unsaturated flow simulation. Thus, the model parameters were identified by fitting to observed data of water retention curve. Exchangeable cations were extracted with strontium chloride. The selectivity coefficients of cation exchange were calculated by use of the Gaines-Thomas equation. The effective cation exchange capacity (ECEC) was obtained from the sum of total exchangeable cations. The vertical root density distribution, transpi-</p>	<p>中川 啓 Nakagawa, Kei</p>

	<p>ration rate, and change of volumetric water content at the deepest soil location of the column were used as numerical conditions. The numerical results for the volumetric soil water variation agreed with observed fluctuations. However, the numerically obtained distribution of ion-species did not agree well with observations. Numerical results showed that the direction of velocity changed in the lower part of the soil column due to changing water level. Adsorption and desorption were promoted by the cation exchange reaction with velocity direction change.</p>	
G 13	<p>マメ科低木メスキート実生の発芽・成長過程に対する浸透圧と温度の影響評価 Evaluation of the effects of osmotic pressure and temperature on germination and growth of Mesquite seedlings</p> <p>Mesquite, an invasive noxious legume, expands widely and rapidly in eastern Africa, and brings many problems on human life. Understanding the process of seedling invasion is crucial in establishing management plan of this species. The purpose of this study is to evaluate the effect of osmotic pressure on seed germination to elucidate the property of initial stages of seedling invasion. Pods were collected six times from 2010 to 2012 (February, June or November) at Al Kadaru and Soba, both are environs of Khartoum, Sudan. About a half of the collected pods were frozen (-20°C, two weeks) to kill insects in them. Seeds were extracted from pods manually, and surfaces of seed coats were scratched gently to promote and to avoid the variation of the timing of imbibition. Solutions with three kinds of osmotic condition (0.4, 0.8 and 1.2 MPa, PEG 6000) were prepared, and germination tests were conducted (eight groups, each 10 seeds x three duplicates, total 720 seeds, 30°C, dark) using these solutions during 25~28 August, 2012. Number of germinated seeds was counted once per day during the experiment. Most of seeds were imbibed soon after soaking in the solutions, regardless of different osmotic conditions. Germination rates were high both in 0.4 and 0.8 MPa conditions, whereas in 1.2 MPa condition, the rates varied among seed groups. Freezing and insect-killing treatment altered less germination rates among the groups. No clear difference was detected in the populations of two collection sites, in the different passage of collection times, and in three collection seasons, which indicate that healthy seeds are produced continuously almost through the year. The properties of seeds, high productivity and wide range of adaptability to osmotic conditions, seem to promote rapid invasion of this species.</p>	<p>依田 清胤 Yoda, Kiyotsugu</p>
G 14	<p>油糧植物ジャトロファの早期開花組換え体創出に関する研究 Production of Early Flowering <i>Jatropha</i> by transgenic method</p> <p>As the first point of this study, an optimized condition by the <i>Agrobacterium</i> transformation method with GUS genes in vectors pCAMBIA 1305.1 has been developed. Appropriate sonication and shaking time have been investigated for two min. and for 8 min, respectively. <i>Jatropha</i> cotyledons leaflets in 3 mm×3 mm sizes were used for the effective transformation materials. Calluses have been regenerated from 100% cotyledons and shoots have differentiated from 28% callus by these experiments. As second point of this study, new construct derived pGWB 11 binary vector with FLOWERING LOCUS T gene (AtFT), which promote early flowering from the <i>Arabidopsis</i> gene has been achieved and transformed to <i>Jatropha</i> cotyledons leaflets. Transformed cotyledons leaflets used for the FT gene transformation were formed calluses and shoots have differentiated from 37.8% calluses in 30 days-old. However they don't still develop the rooting and flowering formation in an early stage of young shoots. The improvement point of the regeneration ratio of the transformed plants is to increase the number of well growth transformed calluses. The causes of the lower survival rate of transformed calluses were the contamination due to the <i>Agrobacterium</i> after infections and culture. The sterilization of the <i>Agrobacterium</i>, and frequent nutrient medium exchange to the growth of the plantlets should be applied to the transformation experimental procedures. Transformation and culture regulating of earlier flowering time would be expected in future.</p>	<p>近江戸 伸子 Ohmido, Nobuko</p>
G 15	<p>耐塩性オオムギの評価と遺伝子マッピング Evaluation and genetic mapping of salt tolerance in barley</p> <p>In this research, barley strain and their hybrid population will be analyzed by using the dessert simulator at a dry land research center. The tolerant lines are planted at the dryland at Kazakhstan. The summary of the results are as follows.</p> <ol style="list-style-type: none"> 1. The experiment by a dessert simulator: materials selected at the salt stress condition at Okayama University are under testing. 2. On July 27 to August 1, I visited two agricultural organizations of Kazakhstan, by a joint research with Dr. Yeran Turuspekov deputy director of the Kazakhstan Biology and Biotechnology Institute. Above barley materials will be planted at the agricultural organization. Drought tolerant cultivars were obtained from Kazakhstan and will be crossed to introduce tolerant genes. 3. Preliminary evaluation of salt tolerance was conducted on a population derived from a cross between salt tolerant cultivar and Haruna Nijo. 4. Based on the genetic map by 384 markers, the analysis of parents and hybrid population is completed. The genetic factors of salt tolerance will be mapped by linkage analysis. 	<p>佐藤 和広 Sato, Kazuhiro</p>
G 16	<p>葉緑体の形質転換技術を用いたストレス耐性コムギの作出 Production of stress tolerant wheat through the use of chloroplast transformation technology</p> <p>Chloroplasts are semiautonomous organelles that contain their own DNA (genome). After pioneering work of Svab et al. (1990), it has now become possible to integrate foreign DNA into chloroplast genome after particle bombardment. In most of higher plants, chloroplast genome is maternally inherited (Hagemann, 2004), and therefore, trans-</p>	<p>寺地 徹 Terachi, Toru</p>

genes in the chloroplast genome are not dispersed through the pollen. This makes chloroplast transformation a valuable tool for the creation of GM crops that are biologically contained and environmentally friendly. In order to apply chloroplast transformation technology to wheat, a series of experiments were conducted. Two DNA fragments containing each of *rbcL-ycf4* and *rps12-16* SrRNA regions in wheat chloroplast genome were cloned into a plasmid vector, and either *aadA* or *npII* gene was added to the constructs as a selectable marker. Ascorbate peroxidase (*apx*) is an enzyme that plays a central role in ascorbate-glutathione cycle in the chloroplast. Since overexpression of *apx* may confer the plant resistance to abiotic stresses, *apx* gene isolated from wheat was also integrated into each construct. To deliver the DNA, PDS 1000-He (BioRad) was employed with 0.6 μm gold particles. Since the experiment requires explants that can regenerate a whole plant, immature embryos were prepared from immature seeds harvested two weeks after anthesis. Preliminary experiments showed that 70% of immature embryos became callus and 80% of calli produced shoots in our conditions. In December 2012, 4,900 and 4,783 immature embryos were prepared from cv. Bob White and cv. Akadaruma grown in a growth chamber in ALRC, Tottori University. Total DNAs were isolated from 16 calli that had survived after antibiotic selection. PCR assay showed amplification of a transgene in some calli, however, convincing evidence that the transgene is integrated into the chloroplast genome could not be obtained. Further studies are needed to produce the first transplastomic wheat.

	<p>オオハマニンニク染色体添加および転座コムギ系統からの耐塩性系統選抜 Screening of salinity tolerance lines from <i>Leymus racemosus</i> chromosome addition and translocation lines of wheat</p>	<p>岸井 正浩 Kishii, Masahiro</p>
--	--	-----------------------------------

G 17	<p>Salt stress is one of big constrain for wheat production in drought and semi-drought area, and it is necessary to produce salt tolerant wheat varieties. But the genetic diversity of wheat itself seems to be not enough to achieve this goal. <i>Leymus racemosus</i>, one wild relatives of wheat in Triticeae is distributing along seashore and possesses strong tolerance against salinity stress (McGuire and Dvorak 1981). Therefore, we can expect higher level of tolerance in wheat by using this species for wheat improvement. We have produced a set of addition and substitution lines where one pair of <i>L. racemosus</i> chromosome added into wheat, as well as translocation lines where a part of <i>L. racemosus</i> chromosome added onto wheat chromosome. The objective of this study is to evaluate salinity tolerance of these lines.</p> <p>Salinity test was conducted using hydroponic system by increasing salt concentration as 50 mM as 150 mM as the final. Reduction % of plant weight between salt stressed plot and control plot was employed for the measure of salinity stress. As the result, some addition lines showed less reduction than parental wheat line of CS. <i>L. racemosus</i> J chromosome addition line showed minimum reduction, while <i>L. racemosus</i> A chromosome addition line showed maximum reduction. Since it was reported that reduction of plant weight under salt stress is due to inhibition in photosynthesis, we measured the photosynthetic activity of the light reaction using a photosynthesis yield analyzer (MINI-PAM). But the activity was different between <i>L. racemosus</i> A chromosome and <i>L. racemosus</i> J chromosome addition lines, indicating that there is no correlation between salt stress and inhibition of photosynthetic light reaction. It would be necessary to investigate on photosynthetic dark reaction in the future.</p>	
------	--	--

	<p>核酸塩基代謝に隠された植物のストレス適応戦略の解明 Revealing a hidden role of nucleobase metabolism in plant strategies coping with stress</p>	<p>坂本 敦 Sakamoto, Atsushi</p>
--	--	-----------------------------------

G 18	<p>It has long been believed that the main physiological function of nucleobase decomposition, in particular catabolism of nitrogen-rich purine bases, is to recycle and remobilize nitrogen from source to sink organ for continued growth and development of plants. Contrary to this current view, we recently disclosed a novel role of purine catabolism in protecting plants from abiotic stress such as drought. Knockdown of the entire catabolic pathway in <i>Arabidopsis</i> significantly enhanced the susceptibility to abiotic stress; however, such stress susceptibility was reversed by exogenous supplementation of purine catabolites such as urate. We therefore postulated the occurrence of purine catabolite(s) or intermediary metabolite(s) that might contribute to defense mechanisms of plants against abiotic stress. In order to investigate their potential role in stress protection, we examined the physiological effects of purine metabolites on stress responses, especially expression of several stress-related genes in <i>Arabidopsis</i> by quantitative RT-PCR and promoter reporter assays. The results showed and certain purine metabolites were able to evoke stress-inducible gene expression, suggesting the involvement of purine catabolism in plant strategies to adapt to environmental adversities.</p>	
------	---	--

	<p>乾燥地での観測設備・機器を守るスマートセキュリティシステムの開発 Development of the smart security system protecting the observation equipment and apparatus in an arid land</p>	<p>村上 健介 Murakami, Kensuke</p>
--	---	------------------------------------

G 19	<p>Theft of research equipment that is installed in arid land has often occurred. It had also become a factor that inhibits the progress of the study. The security system to protect the facilities and equipment observed is urgently needed, there was no precedent. We worked on the development of a smart security system reliable and low cost in the arid land. Security system developed is composed of a monitoring-terminal installed in the field and a cloud server. Monitoring-terminal is composed of a sensor for detecting an intruder, cameras for image acquisition evidence, LED high luminance for threatening intruder, and unit for control and communication, is connected to the Internet through mobile phone. The information from the monitoring terminal is logging and controlled by the cloud server, necessary processing is performed. An email will be sent to the address that is set at the time of intruder detection. The image at the time of detection is sent to the cloud server instantly, logged, can be used as evidence. The conventional intruder detection methods were generally the infrared sensor. For high ambient temperature and the larger the change in the arid land, the use of only the infrared sensor, the problem of reliability, such as false detection had been left. Therefore, in this system, the improved reliability is achieved by using a Doppler sensor in addition to the infrared sensor. As a</p>	
------	--	--

	countermeasure at the time of power- line -cutting, monitoring-terminal has a built-in battery. Further, for threatening intruder, LED high luminance is built. In this study, we worked goal the development of a smart security system suitable for use in arid land. As a result, a system that meets the target specification has been produced. Currently, the prototype is installed on site Arid Land Research Center, verification tests are being carried out. By study of technical problems and cost reduction, we want to aim at the realization of a smart security system that will be used in the field.	
G 20	半乾燥地における形態別抽出法を用いた土壌有機物中のカルシウム複合体の性質 Characterization of soil organic matter associated with calcium isolated by chemical fractionation in semi-arid land	田村 憲司 Tamura, Kenji
	The polyvalent cations in soils play a major role for accumulation of soil organic matter. The major cations involved in the accumulation of soil organic matter are Ca ²⁺ and Mg ²⁺ in arid and semi-arid soils. For the development of our understanding about soil organic carbon dynamics in arid region, it is necessary for soil organic matter associated with calcium to be quantified and characterized. Sodium pyrophosphate is supposed to break down the cation bridges between polyvalent cations and organic matter. Objective of this study was to clarify the relationship between pyrophosphate-extractable Ca content and organic carbon content of surface soil horizons in Eurasian steppe. Organic carbon content ranged from 4.9 to 65.7 g/kg in all samples and increased with increasing mean annual precipitation ($r=0.76$, $P<0.01$). The pyrophosphate-extractable Ca content was 0.61-8.04 g/kg. This was also related to mean annual precipitation ($r=0.58$, $P<0.01$) and to the clay content ($r=0.76$, $P<0.01$). As expected from previous studies, the Ca ²⁺ bridges organic molecules to clay particles because both clays and organic matter are negatively charged. Thus, pyrophosphate-extractable Ca contributed to soil organic carbon accumulation and the content of organic matter associated with calcium was suggested to increase with increasing mean annual precipitation in Eurasian steppe. To characterization of organic matter associated with calcium, further studies such as the content and composition of pyrophosphate - extractable organic carbon are required.	
G 21	半乾燥地の主要作物と根寄生雑草の寄生関係成立要因に関する生理生化学的研究 Physiological and biochemical analyses of interactions between host and parasitic plants	杉本 幸裕 Sugimoto, Yukihiro
	Susceptibility of sorghum and rice varieties to root parasitic weed <i>Striga hermonthica</i> was evaluated. Remarkable differences were observed among 52 rice varieties with parasitism establishment rate ranging from 1 to 70% while the rate was between 20 and 60% among 16 sorghum varieties. It is noteworthy that <i>Striga</i> plants that had infected a resistant rice variety, SATREPS 1, formed three to four leaf-pairs, then turned brown and died. Regarding germination inducing activity of root exudates, sorghum varieties exhibited higher activity than rice varieties. LC-MS/MS analyses revealed that sorghum varieties with high activity produced 5-deoxystrigol. Some varieties also produced sorgomol but no variety was found to produce sorgolactone.	
G 22	中国黄土高原における雑穀の収量性と雑穀の複合環境ストレス耐性機構の解析 Mechanisms of tolerance to combined environmental stress of millets and grain yield of millets in Loess Plateau of China	松浦 朝奈 Matsuura, Asana
	I. Collection of information of culture method and genetic resources of millets in China. I visited China from October 8 to 12. Two millets were harvested and grain yield was measured that were cultivated at research institute of Guyuan for five months. Mean temperature was 17.5°C and total amount of precipitation was 244.4 mm. Grain yield of fox millet and common millet was 235 g m ⁻² and 239 g m ⁻² , respectively. These grain yield may be improved when plants have more panicle and grain per panicle. II. Studies for interspecific differences of environmental stress in millets. <i>Setaria italica</i> , <i>Echinochloa utilis</i> and <i>E. frumentacea</i> were used. Grain yield of all millets markedly decreased under salt stress (150 mM). <i>E. frumentacea</i> was dead at heading. Grain yield of <i>S. italica</i> and <i>E. utilis</i> were attributable to panicle number and number of grain per panicle. There were significant correlation between total dry weight and harvest index and grain yield. Salt stress decreased root growth of all millets. Sodium ion content of leaf and empty grain was higher in <i>S.italica</i> than <i>E. utilis</i> . In conclusion, <i>S.italica</i> showed most combined stress tolerance because of high salt tolerance.	
G 23	ヤトロファ (<i>Jatropha curcas</i>) の根の形態学的特性と環境応答に関する研究 Study on morphological structure and environmental responses of roots in <i>Jatropha curcas</i>	阿部 淳 Abe, Jun
	<i>Jatropha curcas</i> is expected to be cultivated as bio-diesel plants in degraded lands because of its stress tolerance and adaptability to water and nutrient deficient conditions. Although the roots should contribute to those features of this species, the knowledge of <i>Jatropha</i> roots is still limited. The basic structure of root system and root anatomy were investigated with the <i>Jatropha</i> seedlings. The root system of <i>Jatropha</i> seedling consists of the tap root and four roots as its framework. The tap root, with its lateral roots, occupied ca 40% of total root length and weight. Total root length and weight were well maintained even in drought condition with limited water supply to the soil due to the increased partitioning of dry matter to roots. The results of anatomical observation suggested that the four roots are not laterals of tap root; they are rather adventitious roots emerged from the base of hypocotyl. The tap root and the four root developed basically similar anatomical structure. They form the stele with diarch primary xylem poles and the cortex with exodermis and endodermis whose cell walls perform visible autofluorescence under UV microscopy. The maintenance of root length and the modified cell wall structure in the root exodermis and endodermis may contribute to the <i>Jatropha</i> tolerance to soil drought.	

G 24	<p>コムギの乾燥抵抗性改善のための乾燥回避性形質の特定 Identifying relevant drought avoidance traits to improve the wheat productivity under drought environments</p> <p>The main objective of our studies was to improve the drought tolerance in wheat. In the last cropping season in 2012, we conducted field trial to evaluate the relevance of drought relating traits to improve the drought tolerance in wheat.</p> <p>[Materials and methods] The experiment was carried out in a rain-out shelter to avoid the rainfall effects at Hokkaido University. In addition that, 40 cm sand layer was made on the ground to enhance the drought effects. Four wheat genotypes were used (3 genotypes, Cham 6, SW 10 and SW 15 were developed at International Center for Agricultural Research in the Dry Areas (ICARDA), Syria, and 1 cultivar, Harukirari, was developed at Hokkaido Research Organization, Japan). The seeds of each genotype were sown on 3 May 2012. Two irrigation treatments were set, 1) optimal irrigation treatment: periodically irrigated, and 2) drought treatment: irrigation was withheld after the emergence stage. The trials were conducted in mixed model in the treatments as main plots and the genotypes as sub plots with 3 replications. The metrological data in the rain-out shelter were monitored throughout the experimental period.</p> <p>The phenology observation was made properly. The shoot growth and its relating traits, viz., plant height, leaf area and stem number etc., and the canopy temperature were measured periodically, and the carbon isotope discriminations ($\delta^{13}C$) was measured by mass spectrometer at the 6 th leaf stage and harvest time.</p> <p>[Results and discussion] In the drought treatment, the seed yield of all genotypes was decreased compared to the irrigated treatment. There were no significant differences between the irrigation treatments in the canopy temperature as well as $\delta^{13}C$, meaning that there was no clear contribution via the transpiration and transpiration efficiency in this trial. Although the SW 15 had the smallest among the genotypes, the yield reduction in the drought treatment was little. This characteristic on SW 15 could be explained by less reduction of the grain number in the drought treatment. The unchanging grain number regardless of the irrigation treatment on SW 15 was resulted from the changeless ear number between the soil water environments. Since the ear number had a close correlation with the stem number, we are going to be focus on the tiller development which would be a primary trait to make stems.</p>	<p>柏木 純一 Kashiwagi, Junichi</p>
G 25	<p>底面給水型水耕栽培装置を用いた作物の蒸発散モデル構築に関する研究 Modeling of crop evapotranspiration used the closed hydroponics system with capillary uptake method</p> <p>In order to investigate the relation between the amount of water supplied and weather conditions, we constructed a set of hydroponics with Capillary wick irrigation method. We filled plastic containers (W×H×D: 45×9.5×31 cm) with sand, which we called 'sand-bed'. We prepared two types of the beds. One was called the cultivation, in which tomatoes were planted. The thickness of the sand in the cultivation was 6 cm. The other was called the bare ground, in which nothing was planted. There were five beds, each of whose thicknesses was in the range from 2 cm to 6 cm by 1 cm. For weather conditions, we measured the values of temperature, humidity, evaporation, and solar radiation. For the purpose, we also measured both amounts of supplied water and soil moisture contents every hour. For each of the cases, the average of the amount of supplied water was higher in daytime than at night. As for the bare grounds, the 3 cm bed needed the most amount of supplied water, the second the 2 cm bed, the third the 4 cm bed, the fourth the 5 cm bed, and the 6 cm bed needed the least. For the soil moisture contents, regardless of the weather, the highest values were recorded at around five a.m. and the lowest at around two p.m. Even if it was sunny, the change of soil moisture contents for a day was small and the tomatoes were never wilted, so it implied that our system performed its function well. In both the cultivation and the bare grounds, the amount of supplied water conformed to the change of solar radiations. Then, in both the cultivation and the bare grounds there were high correlations between the amount of water and cloudy weather conditions. Based on the finding on the cloudy weather, we constructed fitting models of daily supplied water corresponding to each case.</p>	<p>松添 直隆 Matsuzoe, Naotaka</p>
G 26	<p>寒地型牧草の根系発達に対する土壌水分の影響に関する研究 Study on effect of soil moisture on root system development of temperate grasses</p> <p>This study using root box evaluated the effects of soil moisture deficit on the root development of four temperate grass species: <i>Lolium perenne</i> L., <i>Phleum pratense</i> L., <i>Dactylis glomerata</i> L., and <i>Bromus inermis</i> Leyss. The experiment was conducted in a plant growth chamber set at 18°C, with 14 hr day length. Root boxes (25 cm width, 40 cm depth, and 3 cm thickness) were filled with brown forest soils. Two months after germination, soil moisture treatments (30 days) were started. Root boxes with each grass species were subjected to either dry or control treatment, with weighing every few days and watering to pF values of 3.8 and 1.8, respectively. At the end of treatment, root boxes were decomposed and soils in root boxes were divided vertically into four blocks (10 cm depth each), and horizontally into two blocks (inside or outside 5 cm from the plant base). Root samples were collected from each block. The root length density was measured using WinRhiso. Then their dry weight was recorded.</p> <p>In all grasses, the dry treatment decreased the root length density and root weight. The decline of root length density in the zone shallower than 20 cm was greatest in <i>P. pratense</i> and least in <i>D. glomerata</i>. <i>D. glomerata</i> (especially the inside zone) and <i>L. perenne</i> showed weaker effects of soil moisture deficit on root weight in the upper zone than either <i>P. pratense</i> or <i>B. inermis</i>. Results showed that the effect of soil moisture deficit on root development varied among grass species, and that <i>D. glomerata</i> and <i>L. perenne</i> showed weaker effects of soil moisture deficit than <i>P. pratense</i> in this study. Although <i>B. inermis</i> exhibited the expected high drought tolerance, it showed a stronger effect than that of either <i>D. glomerata</i> or <i>L. perenne</i>, perhaps because of soil differences.</p>	<p>岡元 英樹 Okamoto, Hideki</p>

G 27	<p>高等植物の低窒素ストレス応答における植物ホルモンの役割 Hormonal regulation of responses to low nitrogen stress in higher plants</p> <p>Leaf yellowing was suppressed and promoted by the application of abscisic acid (ABA) and cytokinin in cucumber plants grown under low nitrogen conditions. The accumulation of reactive oxygen species (ROS), which are known as accelerators for leaf yellowing, increased in leaves in the presence of kinetin, which is a kind of cytokinin, whereas it decreased in the presence of ABA. Our research suggests that the reason for the difference of ROS accumulation in cucumber leaves is to increase electron transport activity in PSI by cytokinin and to promote activities of ROS-degrading enzymes by ABA. Furthermore, ABA increased ascorbic acid, which is a substrate of ascorbate peroxidase and an antioxidant, and suppressed ROS sensitivity. On the other hand, large number of starch grains accumulated in the chloroplasts under low nitrogen conditions, whereas only few starch grains were found in chloroplasts of the leaves treated with ABA even under those conditions. It is known that the accumulation of sugars, namely, high C/N ratio promotes leaf yellowing. C/N ratio was slightly increased by kinetin treatment, and decreased by ABA treatment. These results suggest that ABA suppresses yellowing by the promotion of activities of ROS-degrading enzymes and ROS tolerance, and cytokinin promotes yellowing by increasing ROS generation under low nitrogen conditions. Moreover, the difference of C/N ratio may induce the difference of leaf color between ABA treatment and cytokinin treatment.</p>	<p>岡 真理子 Oka, Mariko</p>
G 28	<p>マングローブ植物根系の耐塩性機構の解剖生理学的解析 Anatomical and physiological analysis of salt tolerance in mangrove roots</p> <p>Seedlings of <i>Kandelia obovata</i> were set under different soil (sand or Kanuma pumice) and salt conditions (water or artificial sea water (salt concentration: 1.7‰)), and their root structures were observed and compared by using scanning electron microscopy (SEM). On the surface of white roots grown in sand, much of small typical spherical structure could be found. But, root surface grown in Kanuma pumice looked smooth. In order to avoid shrinking of roots for SEM observation, some pretreatment methods were tried, and the following method could obtain good result; 1) roots were cut and set on cooled Al block by liquid nitrogen, 2) frozen roots were cut and set on another cooled Al block, 3) root samples (with Al block) were set in carbon coater and dried by vacuum, 4) carbon was coated on root samples for SEM observation. About physiological analysis of salt tolerance in root system, electric potential measurement using mallow plants (Dr. An Ping's experimental plants) was tried as preliminary experiment. It was no problem for measurement on this plant species, so we will progress this electrical potential measurement on mallow plants together with mangrove ones.</p>	<p>本間 知夫 Homma, Tomoo</p>
G 29	<p>半乾燥草原植物の乾燥耐性と水利用特性の種間差に関する研究 Researches on species difference on drought resistance and water use characteristics of plants in semiarid grassland</p> <p>Five shrub and nine grass species, which are main vegetation growing in arid/semi-arid grasslands in North-East Asia, were grown under the controlled-environment by using artificially-lit plant growth cabinets. Plants were treated with 4 water stress conditions (-15.2, -6.7, -3.1, -2.6 kPa in water potential) for 4 weeks and the growth and eco-physiological characteristics of each shrub/grass species were analyzed in order to consider the growth performance at desertified grasslands. When water stress became too strong, the growth of any species was suppressed, whereas the impact degree differed in each species which indicated the big difference for adaptation or tolerance to drought conditions of arid/semi-arid area. It was divided into the relatively drought tolerant species (small growth suppression) and sensitive ones (large growth suppression) from the responses of RGR mainly due to the NAR responses. However some sensitive species showed increasing Root/shoot ratio and/or decreasing SLA, which suggest the tolerant responses to survive at the water-stressed conditions. <i>Artemisia halodendron</i> and <i>Agropyron cristatum</i> were drought tolerant species which may be suitable for rehabilitation in desertified area, while <i>Clinelymus dahuricus</i> and <i>Artemisia sphaerocephala</i> were sensitive ones which will be extinct when desertification progressed. Anyway, the tendency against the water stress was not related to life forms such as shrub or grass.</p>	<p>清水 英幸 Shimizu, Hideyuki</p>
G 30	<p>西アジア乾燥地域における伝統的水利用技術と農村開発 The Utilization of Indigenous Technology for Water and Rural Socio-Economic Development in West Asia</p> <p>The field survey has conducted twice in 2012 fiscal year. The first survey has conducted from 4 to 26 August, 2012 for 23 days in rural areas of Iran, first, at the southern part of Iran, Shiraz region, and secondly, at the eastern part of Iran, Birjand region. In the Shiraz region, the persistence of dry weather over ten years and in addition, over-consumption of underground water, using deep well caused extensive damage to the quantity and quality of water except dam canal water. As a result, the young generation rash to migrate to near town, Marvdasht city, "rapid urbanization from village to town" but without job opportunity. In the Birjand region, This is also, as the result of long term drought year over 15 years, the water flow of qanat, traditional underground water system, reduced to the quantity as scoop up water with hand. Cultivated land, farm crops such as wheat and sugar beet were gave up, instead, fruit farm Zereshk (berbery) have been changed. In this region, JAIC team also has done research for 3 years, "Project for study on small farming and rural development plan for poverty reduction in southern Khorasan, Iran". The second survey has conducted from 23 December 2012 to 08 January 2013 for 17 days in the southern part of Morocco, Marrakesh and its surroundings such as Asni, Demelel which is located at the oasis valley of Atlas Mountains and also go over the Atlas Mts.towered the Sahara Desert, Valley of Draa Oasis such as Quarrazate, Andz, Zagora and Mhamid. We could have a</p>	<p>原 隆一 Hara, Ryuich</p>

	chance to visit Prof. Abedella Laounia, Mohammed V University, and had time to exchange of our research views on desert studies and had a short field trip to southern Morocco with his colleague. A research presentation has conducted in 2012 fiscal year. "The Utilization of indigenous Technology for Water Resources and Rural Socio-Economic Development in West Asia- A case study of Birjand Region, East Iran-" (At Tottori University, Arid Land Research Center, Joint Research Conference, Poster session in 2012, Dec. 01~02).	
G 31	<p>木本類および作物における Hydraulic redistribution の評価—干ばつに対応した Intercropping システムでの最適な作物の候補— Magnitude of Hydraulic redistribution in woody and crop plants -promising candidates for suitable crops in an intercropping system under water stress-</p> <p>Hydraulic lift (HL) refers to the vertical movement and exudation of water, usually from subsoil taproots into the surface soil, arising out of a pressure potential created by water loss from the lateral/surface roots. It occurs mainly during hot/dry periods. Hydraulic redistribution (HR) is similar to HL except water moves horizontally. These phenomena have been reported to significantly influence crop irrigation by homogenizing soil moisture. The redistribution of water from deep moist layers to shallow drier layers by large trees has been shown to increase moisture availability to meet transpiration demand during daytime. Despite their significance, little or no information is available about the methods for HR determination in several crops. Information on the conducive/appropriate environmental conditions for evaluation of HL is also largely scanty. The purpose of this study therefore, was to evaluate whether HL or HR was caused in soil and hydroponic culture or not while developing bioassay methods for fruit tree and crop. Two different methods were used; a specialized column that allows subsoil to be watered independently of topsoil and utilizes a plastic bead layer to prevent capillary movement of water from subsoil to topsoil, and a split-root apparatus where crops were linked to each other using two plastic pots under hydroponic culture. HR was determined by monitoring the decrease in osmotic pressure on one side of split-root pot. Results demonstrated the importance of vapor-pressure deficit control which was closely related to the strength of HL in growth chamber. The HL strength for horticultural crops could be evaluated under controlled lower and higher vapor-pressure deficit during night and daytime. Tree roots released relatively stable isotope (D2O: 1.9%-12.1%) from subsoil to topsoil under the above mentioned environmental conditions. For the HR, the roots easily absorbed water from points of low osmotic pressure, and released at the other pot with a solution of high osmotic pressure. Thus, the strength of HR for crops was possible evaluated for a bioassay by using a split-root apparatus in hydroponic culture.</p>	西原 英治 Nishihara, Eiji
G 32	<p>中国黄土高原におけるニセアカシアとリョウトウナラ林における水利用効率の長期変動 Long term changes in water use efficiency of Quercus liaotungensis and Robinia pseudoacacia on Loess Plateau, China</p> <p>In semi-arid region, water use efficiency of plants is affected by the environmental factors such as precipitation. Plants increase their water use efficiency under water limitation. Carbon stable isotope ratio in plant tissue has been used as an index of water use efficiency of plants. In this study we aimed to investigate long term changes in stable isotope ratios of carbon, as an index of water use efficiency, in dominant plant tissues on Loess plateau, China. The study was conducted in the forest on Mt. Gonglu near Yan-an City, China. We have collected litterfall for 10 years (from 2002 to 2011) in two types of forest, i.e. indigenous natural oak forest (Quercus liaotungensis) and imported black locust plantation (Robinia pseudoacacia). In this year, collected litterfall were separate into species and organs, and ground using mill for preparation of stable isotope ratio. Furthermore we collected precipitation data around the study site. In next year, we will proceed stable isotope analysis of dominate plant species. Furthermore we will tackle methodological consideration using litterfall as water use efficiency, because many studies use living plant tissue for investigating for water use efficiency. For this purpose, we will compare carbon isotope ratio between living leaves and dead leaves collected same year.</p>	館野 隆之輔 Tateno, Ryunosuke
G 33	<p>ナシの乾燥ストレス応答における適合溶質の役割 The role of compatible solutes in response to drought stress in Pyrus</p> <p>All seedlings of P. betulaefolia grew normally without toxic symptoms up to 100 mM NaCl treatment during whole experiment periods. At 200 mM treatment, one week after initiation of the NaCl treatment, dark-brownish leaf burn was observed at the base of seedlings. Reductions in photosynthetic rate started next day after initiating the NaCl treatments. P. betulaefolia seedlings showed fast response to salinity stress. For chlorophyll fluorescence measurements, Fv/Fm value also declined on the next day after 200 mM NaCl treatment, indicating that the maximum efficiency of PSII was affected very quickly. To classify the role of compatible solutes against the salinity stress within Pyrus species, expressed sequence tag (EST) analysis was done with various tissues of Pyrus using next generation sequencer (NGS). Two putative genes encoding betaine aldehyde dehydrogenase, one gene encoding betaine transporter, and one gene encoding proline dehydrogenase were cloned and were ready for gene expression analysis.</p>	板井 章浩 Itai, Akihiro
G 34	<p>黄土高原の農村レベルにおける開発効果検証方法の研究 Methodological Studies on Social Development Impact Assessment at Village Level in the Loess Plateau</p> <p>The purpose of this study is to analyze the 'Grain for Green' project and social development in the Loess Plateau, by making cooperative research networks between the researchers of Arid Land Research Center, Tottori University,</p>	縄田 浩志 Nawata, Hiroshi

	Research Institute for Humanity and Nature Initiative for Chinese Environmental Issues, and Research Institute for East Asia Environments, Kyushu University. We published three reviewed article, six book chapters, and six oral presentations last two years. We could start field researches together, by obtaining two funds: 1) Grants-in-Aid for Scientific Research, Scientific Research (B) "Studies on land cover change and its socio-economic factors in the Loess Plateau (China) under the 'Grain for Green' project", 2) Research Institute for Humanity and Nature Feasibility Study "The History of Human-Water Interactions in East Asian Livelihood Complexes".	
G 35	タイ乾燥地に生育する <i>Dipterocarpus alatus</i> に対する土壤中の特異的菌根形成能力保有菌の特定 Determination of mycorrhizal fungi in the soils to form mycorrhizas to the seedlings of <i>Dipterocarpus alatus</i> growing in the dry area in Thailand	岩瀬 剛二 Iwase, Koji
	<p>All of Dipterocarpaceae trees have mycorrhizal symbiosis on their root system, which is of assistance to the colonization and growth of their seedlings in nature. <i>Dipterocarpus alatus</i> in Dipterocarpaceae is native in north to south of Thailand in various kinds of climate including dry forest and one of the main timber tree species in Thailand. By comparison between mycorrhizal fungal flora in the soil of this tree species and mycorrhizas formed with those soils by trap culture, we have tried to determine the fungi specific to mycorrhiza formation.</p> <p>1) Diversity of morphological types of mycorrhizas of <i>D.alatus</i> in natural forests and plantations Soil samples were obtained both from natural forests and plantations of <i>D. alatus</i> in Thailand. Mycorrhizas were morphologically sorted under stereomicroscope to give 12 types in total. Mycorrhizal diversity was higher in natural forests and lower in plantations, but the diversity was increased with the age of plantations. Among 12 mycorrhizal types, the type 3 was found in the highest frequency and was exclusively found in younger plantations.</p> <p>2) Diversity of morphological types of mycorrhizas of <i>D. alatus</i> formed by trap culture Soils samples were obtained both from natural forests and plantations of <i>D. alatus</i> in Thailand. Soils were used directly or after autoclaving to prepare 4 types of soils in total. Seedlings were planted with one of those soils in pots, and the formed mycorrhizas were morphologically sorted under stereomicroscope to give only 3 types in total. Among them, type 3 mycorrhiza was apparently identical to the type 3 mycorrhiza obtained from the field. It seems that the fungus involved in the type 3 mycorrhiza has high potential of mycorrhizal formation as shown in trap culture experiment. While further studies are required in order to clarify the ability for colonization and growth of seedlings in nature, this fungus might be a promising one with high usability for the plantations of <i>D. alatus</i>.</p>	
G 36	中国半乾燥地の木本植物7種の通水特性について Hydraulic architecture of seven woody species in semi-arid area, China	三木 直子 Miki, Naoko
	<p>Maintenance of xylem water transport is critical for plant survival and growth. Although plants distributed in arid regions regulate the occurrence of cavitation to avoid losing water transport, actually, plants can not completely prevent them. In this study, the strategies to maintain hydraulic function were studied in seven semi-arid shrubs (<i>Artemisia sphaerocephala</i>, <i>Artemisia ordosica</i>, <i>Caragana microphylla</i>, <i>Salix matsudana</i>, <i>Salix psammophila</i>, <i>Salix cheilophila</i> and <i>Juniperus sabina</i>), which were distributed in Mu Us sandy land, China. The Ψ 50-values ranged from -0.32 to -4.25 MPa. Species with greater xylem resistance to cavitation had larger safety margin. <i>J. sabina</i> with tracheids had by far the most resistant xylem to cavitation and smaller midday transpiration rate. Therefore <i>J. sabina</i> was very high safety for hydraulic dysfunction. Meanwhile, other six species with vessels were less resistant and safety to cavitation than <i>J. sabina</i>. However, when three <i>Salix</i> species of six species with vessels were rehydrated after dehydration, their hydraulic conductivity recovered at 12 h after rewatering. These results show that <i>J. sabina</i> would be able to maintain hydraulic function by high xylem safety to cavitation derived from tracheids and mitigation of xylem tension. By contrast, though other six species with vessels had lower xylem resistance and safety, they would be able to maintain hydraulic function under variable water condition by hydraulic recovery even if xylem dysfunction occurs. Species in Mu Us sandy land had smaller hydraulic safety compared with other various species having the same life forms. However, they may compensate for less resistance and safety by acquiring precipitation and ground water effectively with deeper root and adventitious root. Therefore, they may be able to survive in water resource-limited habitats.</p>	
G 37	日本における黄砂の沈着量の観測 Observation of mineral dust deposition flux in Japan	長田 和雄 Osada, Kazuo
	<p>Site conditions of Arid Land Research Center are suitable to collect good samples for Kosa dust particles without contamination from locally emitted road and construction dust particles. This study intended to obtain Kosa dust samples deposited via wet and dry processes after long range transport. Wet and dry deposition samples were separately, and weekly, collected by using a deposition sampler (US 330: Ogasawara Keiki, Co. Ltd.). These samples were filtered by Nuclepore filters (pore size: 1.0 micro meter) at Nagoya University. To obtain mineral dust weight on the filter, Fe contents of the filters were measured by the X-ray fluorescence method. Mineral dust amounts were estimated by applying a conversion factor obtained by Ura et al. (2011).</p> <p>Although dust samples collected in FY 2012 were limited for season, deposition flux data were comparable with those during previous study (October 2008 - December 2010). Unlike spring season, dust deposition event is rarely observed during fall to winter. However, relatively high dust depositions were measured for samples during late November to early December, 2012. According to JMA, no Kosa was reported for this period in Japan. Analysis of satellite images and SYNOP reports suggested that dust particles ejected around the Gobi desert on November 27, 2012 were transported toward Korean Peninsula and the Sea of Japan, then, a part of the dusts were deposited mainly by the wet</p>	

	process. Further analysis will be conducted for size distribution of the dust particles.	
G 38	<p>安定同位体比を用いた塩類集積地における塩生植物と土壌間の窒素循環の解明 Nitrogen cycle between halophytes and soil in a salt-accumulated desert determined by stable isotope analysis</p> <p>Soil salinization has been a serious problem in many arid ecosystems in Asia and Africa. Physiological and ecological adaptations of native halophytes should be assessed to restore such degraded ecosystems. Despite considerable studies on salt tolerance of desert halophytes, their nitrogen (N) use is still unclear. We, therefore, revealed the nitrogen use by desert halophytes by using nitrogen isotope analysis. Each soil N pool has a different delta-15 N value because of isotope discrimination during soil processes. No discrimination occurs against 15 N during N uptake and assimilation by plants in N-limited environments. Thus, delta-15 N of leaf organic matter reflects that of specific N source of plants (e.g. ammonium and nitrate). We measured the delta-15 N of leaf organic matter and bulk soil in several halophyte species (<i>Tamarix hispida</i>, <i>Haloxylon ammodendron</i>, <i>Halocneum strobilaceum</i>, <i>Kalidium foliatum</i> and <i>Kalidium cuspidatum</i>) in four experimental plots with different salinity levels near the Lake Aiding in Xinjiang, China. The delta-15 N values of leaf organic matter were 4–5 permil higher than those of bulk soil in most species except <i>T. hispida</i>. This suggests that most species depend on ammonium, which is enriched in 15 N due to ammonia volatilization. On the other hand, the delta-15 N values of leaf organic matter were equal or less than those of bulk soil in <i>T. hispida</i>. This suggests that <i>T. hispida</i> depends on not only ammonium but also nitrate, which is less enriched in 15 N relative to ammonium because of isotope discrimination during nitrification. There is no link between soil salinity and N source by desert halophytes.</p>	松尾 奈緒子 Matsuo, Naoko
G 39	<p>中国寧夏回族自治区固原を拠点とした日中韓共同砂漠化防止研究の展開 Development of the Japan-China-Korea Joint Research for Combating Desertification based in Guyuan, Ningxia Hui Autonomous Region in China</p> <p>1. Growth characteristics of <i>Tamarix</i> We have grown 12 different <i>Tamarix</i> species in the experimental field of the Institute of Soil and Water Conservation in Yangling, China and observed its growth. The results will be appeared in 2014.</p> <p>2. Effects of parasite of <i>Herba Cistanche</i> on the growth of <i>Tamarix</i> We have grown <i>Herba Cistanche</i> on <i>Tamarix</i> in a farm in Dingbian, Shanxi Province. However, since <i>Herba Cistanche</i> was frozen to death in winter 2010–2011 m 2011–2012 in this district, we could not continue this experiment.</p> <p>3. Effects of “Grain to Green Polisy” on Soil and water conservation We have investigated the ecological migration conducted in Yuanzhou district (Guyuan County) located in the southern mountainous area of Ningxia Hui Autonomous Region (NHAR). The ecological migration has started in this area after it was certified as poorest area in 1983. 180,000 people were emigrated in the 11 th 5-year plan period (2006–2010) and 350,000 people have been planned to emigrate in the 12 th 5-year plan period (2011–2015) in NHAR. In Yuanzhou district, 61,948 people (15,204 families) have been planned to emigrate the newly developed irrigation agriculture areas within the same district (24,377 people) and the other district (37,371). It is clarified that the most emigrant who used be nomad have not adapted oneself to the modern agriculture and thus the measures for developing agriculture adapted for the culture, religion, customs of the emigrant as well as educating the emigrant about modern agriculture are required.</p>	大槻 恭一 Otsuki, Kyoichi
G 40	<p>Tamarix を用いた塩類集積土壌の改善技術の開発 The development of remediation technology for the saline soil using <i>Tamarix</i></p> <p>Last year’s studies in the cultivation experiments of <i>Tamarix Austromongolica</i> N. for the improvement of halomorphic soil have showed that <i>Tamarix</i> could grow better with pruning than fertilization in the pot. From the result, we have compared with the pruning timing (in August or September) and the amount of pruning (in 30% or 60% of total foliage) in order to investigate the optimal pruning conditions. For these purposes, a greenhouse cultivation experiment was conducted. Soil, in 45 L containers in four experimental sections of 8 containers each, was mixed with NaCl in concentration of 1% at the field capacity. After transplanting the seedlings of <i>Tamarix</i> in early July, 0.5% saline water was supplied from the bottom of the pot and pruning was carried out with rainfall conditions according to the Inner Mongolia, China. The comparison in the each sections’ foliage dry weight after the cultivation test resulted that the section that was pruned 30% of the total foliage in August showed most growth than others. These results suggested that optimal pruning conditions were exist and further research is needed. In addition, the average of sodium content per 1 g of dry-weight of leaves were 65.2 mg/g and higher than that of roots and stems, and there were no significant differences among four experimental sections. Although the salt removal ratio, which is the amount of accumulated sodium divided by sodium content of <i>Tamarix</i> was 1.5% at most, the predicted amount of sodium absorption will increase gradually for several years.</p>	岩間 憲治 Iwama, Kenji
G 41	<p>マングローブ植物における耐塩機構 Salt tolerance mechanism in mangrove plants</p> <p>We evaluated salt resistance (salinity tolerance) in two mangrove species namely <i>Avicennia marina</i> and <i>Kandelia obovata</i> by conducting a salt treatment experiment in which the trees were grown in Hoagland nutrient solution (40%, pH 5.8). Salt was added to this solution at concentrations of 0% (control), 1%, 2%, 3%, and 4%. The Na⁺ content of tissues in <i>A. marina</i> was 20–40 mg/gDW for the control treatment, but the Na⁺ content increased to 80 mg/gDW for</p>	谷口 真吾 Taniguchi, Shingo

salt treatments of $\geq 2\%$. Moreover, salt excretion from the leaves was 8 times that of the control after a month of the treatment. However, there was no reduction in leaf numbers or leaf surface area as a result of the treatment. There was also no significant difference in growth or dry weight between the treatments (Kruskal-Wallis test, $p > 0.05$). The K^+/Na^+ ratio, an indicator of energy production, decreased in the roots with an increase in the salt concentration. However, the K^+ content varied very little; the Na^+ content showed a tendency to increase. In the roots of *K. obovata*, the Na^+ content tended to increase with an increase in the salt concentration. The numbers and surface areas of the leaves declined with salt concentrations of $\geq 2\%$, possibly because of a decrease in water absorption. Also, the K^+/Na^+ ratio and the K^+ content declined with salt concentrations of $\geq 2\%$, and the growth and dry weight also declined. These experiments confirm that while Na^+ can accumulate to some extent in *A. marina*, there is a mechanism for excreting excess salt via salt glands if salt concentration becomes too high. Thus, although the K^+/Na^+ ratio changed with salt concentrations of $\geq 2\%$, this did not lead to an inhibition of growth or water absorption. In contrast, in *K. obovata*, Na^+ accumulated in the roots; however, a defense mechanism exists to prevent it getting into the stem. Direct effects of salt in organs other than the root can therefore be avoided. However, if the root is exposed to salt concentrations of $\geq 2\%$, the K^+/Na^+ ratio can change and water absorption is can be inhibited. A lack of water may thus contribute to a decrease in leaf numbers and growth.

	中国乾燥地の移動砂丘固定に用いられる小葉楊 (<i>Populus simonii</i>) の乾燥地適応と繁殖戦略、および植栽技術開発に関する研究 Studies on stress adaptability, reproductive strategy and reforestation technology of <i>Populus simonii</i> for sand dune fixation in Kubuchi desert, China	山本 福壽 Yamamoto, Fukuju
--	--	---------------------------

G 42	<p>Simon poplar (<i>Populus simonii</i>) is one of the effective species for revegetation in China, because of rapid growth, adventitious root formation and growth promotion by burial with sand. To evaluate the effect of sand burial on water use and growth of Simon poplar, we compared physiological characteristics of this species in upper and lower stands of a sand dune slope in growing season of 2012. Although sap flux density and its response to water vapor deficit were similar between the sites, leaf scale measurement of stomatal conductance and transpiration were smaller in the upper site than the lower site. Total sap flow was large in the upper site, which results from large leaf area. At the same site, eco-physiological investigations for native herbaceous plants including <i>Phragmites communis</i> and <i>Psammochloa villosa</i> were performed to determine their growth and stress tolerance. Those species are possible plants for sand dune fixation in Kubuchi desert. There was no difference in growth of both species between the upper and lower stands. However, <i>Ps. villosa</i> can accumulate greater amount of glycine betaine in leaves in comparison with that of <i>Ph. communis</i>, which slightly accumulated alanine betaine. In Tottori sand dune, non-sand buried, 50% buried and 100% buried cuttings of four Salicaceae species including Simon poplar, <i>P. alba</i>, <i>Salix psammophila</i> and <i>S. matsudana</i> were prepared to compare their growth pattern and tolerance against sand burial environment. In one growing season, Simon poplars showed highest survival rate and tolerance among those species.</p>
------	---

	土のキャピラリーバリアを利用した根群域の保水性向上と地下水からの塩水侵入阻止に関する研究 Enhancement of Soil Water Retention Capacity in Plant Root Zone and Interception of Upward Saline Water from Groundwater by Using Capillary Barrier of Soil	森井 俊広 Morii, Toshihiro
--	---	---------------------------

G 43	<p>A simple soil layer system which is composed of a finer soil layer underlain by a coarser soil layer provides a characteristic property of capillary barrier (CB). Water infiltrated into soil is suspended just above an interface between soil layers due to a physical difference in unsaturated hydraulic properties of soil. As their roots can easily utilize the water retained in the upper soil layer, agricultural plants grow even under water saving irrigation. Because the gravel layer embedded in the soil cuts upward movement of water from groundwater, the CB is expected to provide an effective prevention of salinization which is caused by salt included in the groundwater. Two series of field experiment were conducted to investigate a practical effectiveness of the CB in water harvesting and salinization prevention. In the field experiment for water harvesting, experiment plots were constructed, green vegetables were planted on them, and soil moisture contents were measured after seeding to harvesting of the plant. The water retained in the upper sand layer was observed, and its effect on the plant growth was quantified by a statistical analysis of the plant harvested. In the series of field experiment for salinization prevention, the CB plots were constructed in polyester container boxes, and connected to the water tank which could supply an artificial groundwater, 10,000 ppm of NaCl, to the plots with a constant head of water. Soil moisture content and electric conductivity in the experimental plots were measured after plant to harvest of the green vegetable. The gravel layer embedded in the CB plot at some depth above the groundwater surface could well prevent the water from moving upward from the groundwater surface. Both series of field experiment reveal that the CB is well applicable to the water harvesting and the salinization prevention.</p>
------	--

	乾燥地における灌漑農業による土壌環境評価 The evaluation on soil environment affected by irrigation at arid land	東 照雄 Higashi, Teruo
--	--	------------------------

G 44	<p>Low infiltration rate of soils in Nile Delta due to heavy clay texture was considered to accelerate salt accumulation in soils. In addition to that, most of crop residues were burn in the field and rarely used efficiently as soil amendments in the Nile Delta. Therefore, the present study focused on the changes in water and salt movement after mixing a crop residue, rice husk, into heavy clay soils in the middle Nile Delta. The amounts of applied rice husk were 10 t/ha and 20 t/ha, and the effects were studied in both column and field experiments.</p> <p>In the column experiment, water contents of soil samples from 20 t/ha treatment were higher than those from other</p>
------	--

	<p>treatments before drying. However, after two weeks drying, the difference in among treatments was disappeared, so the excessive water evaporated during drying. The values of EC showed little differences among treatments.</p> <p>In the field experiment during the winter crop cultivation 2011, On 20 t/ha rice husk treatment plots, the values of EC showed the higher values at 20 cm depth than those of other depths. This may be resulted from secondary evaporation front made by cracks. During summer crop cultivation 2012, the values and the variability of EC among each triplicate treatment were higher in control and 10 t/ha treatment than in 20 t/ha treatment. Heterogeneities of the soils in the field and of the quality of groundwater were seemed to be related with the variability of salt amounts in soils. Increasing of macro-pore and buffering capacity by mixing rice husk was considered to be responsible for lower value of EC in 20 t/ha treatment. Although there were little significant effects, the potential of positive effects by mixing rice husk for suppressing salt accumulation was suggested and the effects would accelerate by continuous application of rice husk.</p>	
G 45	<p>TDR 大型多線式プローブによる面的土壌水分・塩分測定法の開発と圃場への応用 Two dimensional measurement of water content and salinity in surface area through TDR with multi-long lods</p> <p>A multiple-rod TDR probe developed in this project enabled the TDR measurement to extend over a large area in the field. The characteristics of the multiple-rod probe were examined in sand in a container of 1.1 m' 0.81 m' 0.20 m. A multiple-rod probe consisting of seven rods and with the same probe specifications was inserted horizontally in the sand of the container at 10 cm below the surface. The dielectric constant and EC of the sand were measured with during an evaporation test. Additionally, typical commercial TDR short probes (0.07 m length) were placed in the space between rods of a multiple-rod TDR probe and measured the change in water content and EC. The comparison between a multiple-rod measurement for water content and the average of 15 short probes showed same values, but, different for EC. It concluded that the local inhomogeneity of solute concentration in the soil affected stronger than the water content.</p> <p>Further experiments were carried out in order to verify the previous results using improved equipment in higher accuracy and modifying set-up manners. It is revealed that even the water content has difference between a multiple-rod measurement and the average of short sensors. Finally, the space distribution of measurement sensitivity for a rod of the probe could prove the difference clearly.</p>	<p>長 裕幸 Cho, Hiroyuki</p>
G 46	<p>燃料作物の消費水量の算定と環状剥皮による根の更新の検討 Evaluation of water requirement for fuel crop and the renewal of root system by girdling.</p> <p>Field observation was conducted to investigate the crop water requirement of fuel crops in commercial field with relatively high ground water table, located in Ismailia, Egypt. Jatropha and castor-oil plants were grown in sandy soil with drip irrigation using drained water. Heat ratio methods were applied to measure transpiration rate for more than one growth season. The phenology of jatropha shows that the leaf foliation started from June and leaf fell in December. Changes of heat pulse velocity had a good agreement with the phenology of jatropha. In case of castor-oil plants, heat pulse velocity was high during winter season with ever-green conditions and temporarily transpiration activity increased with hot air advection from arid area. The lowest heat pulse velocity was obtained in September with many fallen leaves. Several calibration methods were examined to quantify transpiration rate for both species. Potometrically measurements were applied in the field. For jatropha, sap flow was ceased and stomata was closed after cutting stem base. It is concluded that we need to calibrate by weighing method with root balls. For castor-oil plants, we dig sand and left some surface roots, then sap flow was not ceased without decreasing stomatal conductance. To apply water flow through both cut stem segments, there are some relationship between flow rate and the heat pulse velocity. However, we need to investigate moreover. Crop water requirement of castor bean was estimated lower than irrigation water amount and it is concluded that particular plants investigated with sap flow method did not uptake ground water.</p>	<p>竹内 真一 Takeuchi, Shinichi</p>
G 47	<p>キャピラリーバリア存在下でのリーチングによる除塩の可能性と限界について Possibility and limitation of desalinization by leaching under the condition of existence of a capillary barrier.</p> <p>Existence of a coarse-textured soil layer inhibits percolation and capillary rise of soil water in stratified soil. This phenomenon is called "Capillary barrier" and the layer is called the capillary barrier layer (CB layer). It increases water retention ability of a plow layer, and protects salt-accumulation caused by capillary rise of saline water. However there is possibility that the CB layer become an obstacle for leaching. In this study, soil column experiments were conducted in order to assess salt and water movement in a plow layer before and after leaching. Two types of soil columns were prepared for the experiments. One is the column packed only sandy soil (S-column), and the other is the sandy soil column with a gravel layer as a CB layer below the plow layer (CB-column). Both columns had shallow ground water of 12 dS/m at the bottom of soil column. At first, these columns were saturated with saline water of 12 dS/m. After excess water evaporated and accumulated-salts clearly appeared at soil surface, leaching experiments were conducted using distilled water. They were kept in a constant temperature and humidity room of 25°C and 25%. Soil in these columns was sampled before leaching as initial condition. Moreover, soil was sampled on the first and the seventh days after leaching. As results, salts content of plow layer in the CB column was 1/3 of the S column and EC of soil surface in the CB column was 1/10 of S column. It clarified that the existence of the CB layer don't affected leaching for high permeable soil such as sandy soil and it remarkably inhibited capillary rise of saline water. However, it was not entire. We should conduct more detail analysis on salt and water movement near the CB layer.</p>	<p>猪迫 耕二 Inosako, Koji</p>

	<p>乾燥地深層地盤における水分塩分挙動観測技術の開発 Development for monitoring technique of soil water and solute transport in deep vadose zone in arid land area</p>	<p>黒田 清一郎 Kuroda, Seiichiro</p>
G 48	<p>We evaluate the applicability of Ground Penetrating Radar (GPR) for characterization of subsurface structure and groundwater in arid land, which control the transport phenomena of water and solute transport in vadose zone. We conducted the field test in the fields of Arid Land Research Center, Tottori university, using the GPR system with shielded antennas of dominant frequencies, 100,200,400,500,900,1.5 GHz. Soil type in the field is almost uniform sand, and water content of soil is around or lower than 5%. Then soil is considered to be lossless media in electric magnetic sense. Penetration depth of each antenna is deeper than values usually reported. For example penetration depth of the system with 100 MHz antennas is considered to be in the range from 20 to 30 m. We visualize 3 D subsurface structure using the 100 MHz antenna. The obtained image shows the distribution of ground water table and layer which seems volcanic ash seam in sand and will control water recharge process in vadose zone. Based on these results of field investigation, we made a plan of infiltration and tracer injection test into sand field in Tottori university. In this test we will evaluate the applicability of time-lapsed geophysical prospecting including GPR for monitoring soil water and solute dynamics of vadose zone in arid land.</p>	
G 49	<p>温度勾配下の土中水蒸気移動を利用した節水灌漑に関する研究 Micro-irrigation based upon vapor transport in soils under temperature gradient</p>	<p>斎藤 広隆 Saito, Hirotaka</p>
G 49	<p>Salt affected lands can be found in many arid and/or semi-arid areas because highly saline water is used. When shallow saline groundwater exists, salts often accumulate near the soil surface through capillary rise. During capillary rise, water moves upward to the soil surface against the gravity. When water evaporates at the surface, salts are left behind, resulting excess salt accumulation near the surface. To suppress capillary rise of saline groundwater, the concept of capillary barrier has been used by placing a layer with materials having larger pores such as gravel. In this study, column experiments were conducted to investigate the effect of gravel layer thickness on capillary rise and salt accumulation at the surface. We also investigated the effect of enhanced water vapor flow in unsaturated soils to use heat energy for irrigation purposes in arid or semi-arid regions. The basic idea is to use intercepted liquid water during capillary rise at the gravel layer by transforming it to water vapor and transporting water vapor by an artificially created temperature gradient to the surface soil. This approach allows us to avoid surface soils from salinization. The experimental results show that when the gravel layer is 2-cm thick, vapor flux through the gravel layer does not increase much even if the temperature below the gravel layer was increased from 30 C to 50 C. On the other hand, when the gravel layer was either 4 or 6 cm, vapor fluxes were dependent on the temperature.</p>	
G 50	<p>乾燥地および寒冷地に生息する野生霊長類の各種行動形質と生息環境との関連性 Relationships between behavioral traits of wild primates inhabiting dry and cool regions and their habitat environments</p>	<p>辻 大和 Tsuji, Yamato</p>
G 50	<p>We analyzed regional variation in the dietary regimes of two primate clades, Asian macaques and colobines, whose distributions include temperate-alpine forests. We addressed feeding strategies that enabled them to adapt to harsh environments characterized by relatively low mean temperatures and strong seasonality in both temperature and food availability. Macaques in tropical-lowland forests feed mainly on fruits and animal matter, whereas populations in temperate-alpine forests feed more on foliage and other items, such as bark and fungi. In comparison, colobines in tropical-lowland forests feed more on fruits and foliage, whereas populations in temperate-alpine forests feed less on flowers and more on lichens. Annual precipitation and mean temperature, both of which reflect primary production, had the most significant effects on the feeding behavior of macaques, whereas only mean temperature had significant effects on that of colobines. We found two behavioral strategies used by both clades to cope with severe environmental conditions in temperate-alpine forests: 1) shifting to other dietary items, and 2) adjusting feeding plasticity for fruits and foliage. Macaques responded to latitudinal changes using both strategies, whereas the colobines adapted using only the latter. By contrast, altitudinal changes resulted in the macaques' using the latter strategy and colobines' using both. The differences in the present distributions of Asian macaques and colobines would be attributed to differences in their feeding strategies originated to their digestive systems. As to Japanese macaques, we also showed that their dietary diversity is negatively correlated with vegetation index within study sites.</p>	
G 51	<p>菌根菌ネットワークによる塩類ストレス下における樹木間養分転送機構の解明 Mechanisms of nutrient transfer among trees via mycorrhizal network under high salinity conditions</p>	<p>山中 高史 Yamanaka, Takashi</p>
G 51	<p>We examined ability of ectomycorrhizal (EM) formation on <i>Pinus thunbergii</i> and <i>Alnus firma</i> after inoculation with 7 species of EM fungi for choosing EM species adequate for formation of ectomycorrhiza with pine and alder together. Seedlings of pine and alder cultivated in a plastic pot were inoculated with isolates of EM fungi (<i>Pisolithus tinctorius</i>, <i>Astraeus hygrometricus</i>, <i>Scleroderma reae</i>, <i>Laccaria amethystea</i>, <i>Paxillus involutus</i>, <i>Gyrodon lividus</i> and <i>Alpova</i> sp). <i>Pisolithus tinctorius</i> and <i>A. hygrometricus</i> formed EM on pine; <i>Alpova</i> sp. formed it on alder. No EM species formed its EM on both trees. To assess the usefulness of stable isotope ratio for understanding nitrogen cycling we measured $\delta^{15}\text{N}$ in these pine and alder inoculated with EM fungi and N-fixing bacteria (<i>Frankia</i>). The $\delta^{15}\text{N}$ value in alder with <i>Frankia</i> was lower than that without <i>Frankia</i>. It suggests that analysis of the $\delta^{15}\text{N}$ value of plants is available as a tool for specifying the origin of nitrogen sources.</p>	

	<p>樹体内水分モニタリングと水の安定同位体分析を用いた乾燥地樹木の水利利用戦略解明 Clarification of water use strategy of trees in arid lands based on tree water monitoring and water stable isotope ratio analysis</p>	<p>齊藤 忠臣 Saito, Tadaomi</p>
Y 1	<p>The objective of this study is to clarify the water use strategies of trees in arid environments based on soil-tree water monitoring and stable isotope ratio analysis of water. Target trees were Screwbean mesquite (<i>Prosopis pubescens</i>: native species) and tamarix (<i>Tamarix ramosissima</i>: invasive species) in North America and mesquite (<i>Prosopis juliflora</i>: invasive species) in Sudan. One research site (Riverside, NV) and three research sites (Alkadar, Soba, El-rawakeeb) were established in America and Sudan, respectively in 2012. The results from the sites in Sudan on tree water monitoring showed that outputs from the dielectric probe inserted in xylems in mesquite trees were severely affected by temperature, indicating that temperature calibration is needed to determine accurate tree water content. Thus, we have developed a new calibration method for temperature dependency of dielectric probes using time series of field data. The results from stable isotope ratio analysis of water showed that mesquite in Sudan used not only ground water but also deep soil water especially in rainy season. In America, both mesquite and tamarix used shallow saline ground water, suggesting that not only tamarix but also mesquite are salt tolerant species.</p>	
	<p>蔬菜の養液栽培における塩水の利用 Utilization of saline water in soilless culture system for growing vegetables</p>	<p>近藤 謙介 Kondo, Kensuke</p>
Y 2	<p>Soilless culture is one of the cultivation methods, which is able to grow plants in any soil or soilless condition. It was investigated that effects of different concentration of salt in nutrients solution on the growth and quality of vegetable in a hydroponic system with deep flow technique. Objective of this study is in order to get basic data for introducing the soilless culture at arid or semiarid land. Mizuna were grown in the deep flow technique at glasshouse. Nutrient solution was used a half strength of Otsuka A solution with an electric conductivity (EC) of 1.3 dS m⁻¹. The experiment comprised four different NaCl concentrate nutrient solutions, which was 0 mM (1.3 dS m⁻¹), 20 mM (3.3 dS m⁻¹), 50 mM (6.5 dS m⁻¹), and 100 mM (11.3 dS m⁻¹) NaCl. The growth of mizuna was not inhibited 0 to 50 mM NaCl treatments. There was tendency that SPAD value (leaf chlorophyll content) was increased in higher NaCl concentration treatments. Total sugar contents, ascorbic acid contents, and nitrate concentration were affected by NaCl treatments. Sodium contents were increased and potassium contents were decreased in higher NaCl concentration treatments. It was suggested that mizuna absorbed sodium in nutrient solution and the mechanism was involved in potassium. The next experiment is needed to study with growing vegetables using different type of salt in the closed hydroponic system.</p>	
	<p>降水量に沿ったニセアカシアの水利利用の推移様式の解明 Analysis of geographical trend in transpiration by <i>Robinia pseudoacacia</i> plantation along precipitation gradient</p>	<p>宮沢 良行 Miyazawa, Yoshiyuki</p>
Y 3	<p>This study aimed to construct the soil-plant-atmosphere water transport model and the successful modeling of the transpiration by a plantation species, <i>Robinia pseudoacacia</i>. We collected leaf photosynthetic traits in two study site in Loess plateau and in Alrc as model inputs and compared the modeled transpiration rate with the monitored rates using sap flow measurements. The photosynthetic inputs changed drastically between this year and last year, suggesting the plastic response to the drought conditions. The modeled transpiration rate overestimated the measured one in midday in summer and the discrepancy did not disappear even when different values of model inputs were used, suggesting that leaf-level transpiration or stem water conductivity processes were not responsible for the discrepancy. On the other hand, modeled transpiration rate well matched the measured one in spring in the values and the diurnal patterns, suggesting that major processes in transpiration were well represented in our model. Previous studies suggested that sandy soil surrounding the rhizosphere dries up very quickly for rapidly transpiring trees and the dry soil layer restrict the root water uptake and transpiration rate rather than the stem water conductivity or leaf-level transpiration processes (Tuzet et al., 2003). In order to examine the effects of root water uptake processes, further studies should reveal the amount, depth and the profile of the roots to improve the model prediction.</p>	
	<p>モンゴル草原における低嗜好性雑草 <i>Artemisia adamsii</i> の定着と拡大 Establishment and expansion of a low palatable weed, <i>Artemisia adamsii</i>, in the Mongolian steppe</p>	<p>衣笠 利彦 Kinugasa, Toshihiko</p>
Y 4	<p><i>Artemisia adamsii</i> is a perennial weed that rapidly expands after colonizing disturbed areas. In a Mongolian steppe, <i>A. adamsii</i> distribution is expanding because of human disturbances such as overgrazing. As <i>A. adamsii</i> is low palatable for livestock, its expansion decreases the quality of pasturelands. Therefore, colonization and expansion of <i>A. adamsii</i> should be controlled to maintain the value of Mongolian pasturelands. <i>A. adamsii</i> produces several small seeds and expands via rhizomes. Thus to control the colonization and expansion of <i>A. adamsii</i>, seed germination potential and rhizome elongation must be understood. We investigated <i>A. adamsii</i> seed production and seed germination characteristics in 2012 to evaluate the potential for colonization and expansion of <i>A. adamsii</i> through seed propagation. In the surveyed <i>A. adamsii</i> population, approximately seven seeds were produced per head and approximately 52 heads were found in each reproductive shoot. As the number of reproductive shoots was 458 per square meter, <i>A. adamsii</i> seed production in this population was calculated to be approximately 160,000 per square meter. <i>A. adamsii</i> seed germination under light conditions demonstrated temperature dependency with an optimal temperature of approximately</p>	

	<p>18°C, which corresponded to the monthly mean temperatures of June and August in the study area. At optimal temperature, percent seed germination was approximately 80%. Percent seed germination under dark conditions was lower than under light conditions, demonstrating that <i>A. adamsii</i> seed germination is light dependent. Taken together, <i>A. adamsii</i> produces abundant seeds and approximately 80% of seeds germinate under sufficient light and optimal temperature. Therefore, to suppress <i>A. adamsii</i> expansion, clear cutting of aboveground parts before seed production with simultaneous prevention of dormant seed germination may be effective. The expansion potential via rhizome elongation and shoot recovery after clear cutting should be investigated in a future study.</p>	
Y 5	<p>土壌コロイドの界面化学特性に基づく土壌改良剤の侵食抑制機能の解明 Elucidation of the control mechanism of soil erosion by soil conditioners on the basis of colloidal properties of soil particles</p> <p>We examined the electric charging and flocculation (sedimentation) behaviors of fine portion (<0.076 mm) of Tottori masa soil, the water erosion of which has been concerned. The results of zeta potential of the soil showed that 1) the particles carry negative surface charge, 2) the zeta potential depends on pH, and 3) the magnitude of zeta potential increases with increasing pH. The particles flocculated at low pH where they have low surface charge density. Increasing electrolyte concentration of soil suspension gave rise to the flocculation and subsequent sedimentation. The critical electrolyte concentration required to induce flocculation was higher for NaCl than that for CaCl₂. That is, flocculation behaviors of the soil particles qualitatively followed the DLVO theory. We also set up a laboratory-made rainfall simulator and carried out erosion and infiltration experiments under the constant intensity of rainfall. In the experiments, we applied rainfall and monitored the temporal variation of infiltration rate and turbidity of runoff water. The experimental results showed that surface runoff occurred even in the fast flocculation regime, where we can neglect the electrostatic repulsion inducing chemical dispersion of soil. The surface runoff is probably related to physical dispersion due to raindrop impact. The start time of surface-runoff became longer as the rainfall intensity decreased. We did not observe the significant effect of the valence of counter ions on the relationship between infiltration and time.</p>	<p>小林 幹佳 Kobayashi, Motoyoshi</p>
Y 6	<p>写真測量によるリル侵食メカニズムの解明 Study on mechanism of rill erosion using photogrammetry</p> <p>Interrill soil erosion depends on primarily on soil detachment by raindrop impact (splash) and the transport capacity of thin sheet flow. The detachment capacity of interrill flow is negligible compared to that of raindrop splash. Splash is correlated with soil strength for both uncrusted and crusted conditions for finer textured soil. Soil strength is related with soil moisture, for example the strength measured with fall corn increase when moisture increases. An increase in surface soil strength or cohesion normally occurs during a rainfall event, if the soil is near field capacity or wetter. A decrease in soil detachment is associated with this increased strength. Many of the particles involved in soil splash processes promoted by rainfall energy have characteristic dimensions on the millimeter scale. The modeling and quantification of such processes require detailed measurements of the physical, chemical, and biological properties of soils. However, these measurements are too slow, tedious, and expensive for routine or regular monitoring. The previous measurement of splash has been conducted with the single water drop more frequently than splash from whole soil surface under rainfall. The photogrammetry measurement was applied to analysis the mechanism of the splash process. This measurement could measure the change of soil surface with millimeter scale in comparatively large area. The result was found that the soil consolidation during the rainfall event induced by rainfall energy might be functioned to reduce the amount of splash by raindrop.</p>	<p>森谷 慈宙 Moritani, Shigeoki</p>
Y 7	<p>過放牧による飼料中ミネラルバランスの劣化がモンゴルの家畜の健康性に及ぼす影響 Effect of dietary mineral imbalance due to overgrazing on Mongolian livestock health</p> <p>Past studies indicate that increasing plant diversity in pastures may prevent mineral deficiencies or excesses in grazing animals. We tested this hypothesis by comparing traditional Mongolian nomadic pastoral grazing through which we expected livestock to consume more plant species, with grazing in a settled area with less plant diversity. The study areas were situated in Terelj and Erdene in Mongolia's steppe ecologic zone. For both areas, we surveyed the vegetation and the food habits of livestock and compared the mineral concentrations in samples of plants, cattle hair, and sheep wool. Plant species diversity in vegetation and rumenal contents was greater in the nomadically grazed area than in the settled area. We found that the average macromineral contents of hair and wool were lower in the settled area than in the nomadically grazed pastureland, except in the case of K in sheep wool. This difference can be explained by the finding that animals restricted to grazing in the settled area predominantly consumed a single plant species with poor mineral nutrition. In contrast, the micromineral content (including potentially toxic elements) of sheep wool was lower in the nomadically grazed area. These findings suggest that nomadically grazing improves the mineral balance of livestock through the intake of diverse plant species.</p>	<p>吉原 佑 Yoshihara, Yu</p>
Y 8	<p>バイオフィーム形成細菌による塩類集積土壌での植物根の保護 Protection of plant root by using biofilm producing bacteria in the salt accumulation soil</p> <p>The rhizo-bacteria, 127 strains, were isolated from the rhizosphere soil of <i>Carex kobomugi</i> growing in the sea side of Arid Land Research Center, Tottori University. At first, 20 strains which formed jellylike colony on the medium were selected. PCR-RFLP showed 8 types of bacteria from the band pattern of the 20 strains. The selected 8 strains were estimated to genus <i>Pseudomonas</i> (3 strains), <i>Achromobacter</i> (1 strain), <i>Bacillus</i> (1 strain), <i>Lysinibacillus</i> (1</p>	<p>片岡 良太 Kataoka, Ryota</p>

strain) by sequencing analysis. Other 2 strains are still analyzing as unknown. This research aim is to use the useful bacteria under salt accumulating soil for crop cultivation. Therefore, selected bacteria were confirmed whether they resist salt or not. R2A media adjusted to 0 mM, 100 mM and 300 mM of NaCl were prepared and 100 μ L of each bacterial suspensions (O.D.600=1.0) were inoculated. The cultures incubated using shaker at 25°C. The result showed that almost strains grew in the medium with 100 mM and 300 mM of NaCl and the growth pattern was the same as the medium without NaCl, while only *Lysinibacillus* sp. depressed the growth in the medium with 300 mM NaCl. In contrast, *Pseudomonas* sp. and *Achromobacter* sp. grew well in the high concentration of NaCl. These strains were thought to be halotolerant bacteria.

M 1	ジャトロファ研究会 Jatropha Workshop	福井 希一 Fukui, Kiichi
	<p>We held the 6th International Symposium "Green Biotechnology for Global Sustainability" at Senri Life Science Center (Toyonaka city, Osaka) on March 9th and 10th. It is the international symposium aiming mainly to exchange information and discuss about research of the biofuel crop jatropha. We invited Dr. Qu Jing from Temasek Lifescience Laboratory (TLL), Singapore, and Prof. Adel Hegazy from Minufiya University, Egypt, as keynote lecturers. On March 9th, Dr. Qu talked about the latest research results of TLL on the transgenic jatropha development with new functions, such as virus resistance or high oil content. On March 10th, Prof. Adel talked about the promising oil crop, jojoba, in Egypt and its propagation using tissue culture and other methods. Other 16 papers from Japan were also presented and actively discussed. Among them, 9 papers were presented by members of "jatropha workshop" (see "Achievements"). They were about cultivation, molecular biology, and metabolites of jatropha, as well as about related topics, such as mycorrhizal fungi, plant size regulation, parasitic plants, or triterpenoid biosynthesis. Number of participants was 43. Participants of Japan were from Tottori University, Osaka University, Teikyo University of Science, Osaka Prefecture University, RIKEN, Nagoya University, Japan Development Institute, Japan International Research Center for Agricultural Sciences, Kinki University, Nara Institute of Science and Technology, and the National Institute of Agrobiological Sciences.</p>	
M 2	乾燥地における森林と水の関わり Forest and Water in Arid Lands	大槻 恭一 Otsuki, Kyoichi
	<p>In the international conference, six sessions (A: Water Quality & Carbon Sequestration, B: Ecohydrologic Processes, C: Forest & Water in Semi-Arid & Arid Lands, D: Water & CO₂ Exchange between Forest and Atmosphere, E: Soil & Water Conservation in Forested Watersheds, F: Innovative Technology and Systems for Sustainable Forest Water Resources) were held. In the first day (Sep. 18), six active researchers (USA: Dr. W. Brutsaert, USA: Dr. J. Vose, Korea: Dr. J. Kim, Sweden: Dr. K. Bishop, China: Dr. Y. Wang, Japan: Dr. Y. Onda) related to the six session topics gave the open keynote lectures. In the second day (Sep. 19), 31 oral presentations and 34 poster presentations related to the session A-D were performed, and two open keynote lectures related to climate and meteorology were given by two distinguish researchers (USA: Dr. H. Diaz, USA: Dr. T. Giambelluca). In the third day (Sep. 20), 23 oral presentations and 38 poster presentations related to the session E-F were performed, and two open keynote lectures related to ecohydrology were given by two distinguish researchers (Australia: Dr. L. Zhang, Japan: Dr. F. Nakamura). In the final session, the topics and discussions in each session were summarized, the future perspectives of the studies were discussed, and continuation of the conference to exchange information was determined. In the C session related to arid land research, the current issues of arid land were presented and discussed by arid land researchers around the world including two invited speakers (Mexico: Dr. C. Israel, Japan: Dr. N. Yamanaka). After the conference in the second day, arid land researchers got together in the academic networking party and had continuous fervent discussions.</p>	

1.4 国内外との交流

(1) 国際共同研究

干ばつメモリの動態

期間：2008年4月～2013年3月

代表者：篠田雅人、鳥取大学乾燥地研究センター

組織：鳥取大学乾燥地研究センター（篠田雅人）・カザフスタンブラエブ作物学研究生産センター・モンゴル気象水文研究所

研究費：科学研究費補助金 基盤研究（A）（海外）

課題：世界の陸地の約4割を占める乾燥地では、今後、干ばつが増加し、すでに困難に直面しているその水資源、農業生産、生態系が悪影響をこうむる可能性が高い。本研究では、ユーラシア草原において干ばつという外的強制力を受けて、乾燥状態が「土壌水分→植生→動物」と進んでゆく干ばつメモリの動態を解明し、干ばつという攪乱に対する生態系の感受性・復元力という視点からその持続性を評価した。

持続的食糧生産のためのコムギ育種素材開発プロジェクト

期間：2011年4月～2016年3月

代表者：坂智広

組織：横浜市立大学（坂智広）・鳥取大学乾燥地研究センター（辻本壽、アミン・エリタエブ）・理研（松井南）・JICA アフガニスタン事務所（M. Osmanzai）

研究費：JST・JICA

課題：この研究の目的はアフガニスタンのコムギの地方品種と近縁野生植物の収量および品質に関する育種において可能性を最大限発掘することにより、それらを保全することである。本研究において、私達は野生植物タルホコムギの多様性を包含するアフガニスタンの地方品種「Sephadak Ishkashim」集団を育成した。この集団をアフガニスタンの試験場で栽培し、ストレス耐性について選抜する予定である。

コムギ近縁野生植物の乾燥及び栄養高効率性の遺伝資源の開発及び応用的研究

期間：2011年1月～2013年12月

代表者：王仕穩

組織：中国科学院水土保持及び生態環境研究センター（王仕穩）・鳥取大学乾燥地研究センター（辻本壽、田中浄）

研究費：中国科学院

課題：乾燥及び少ない肥料条件下でのコムギ生産は今日および今後の大きい課題である。本研究では、私達は野生植物の遺伝子をもつコムギを中国西北地域において乾燥及び節肥性の選抜を行い、その結果をコムギ育種に応用する。

モンゴルの野生哺乳類大移動の保全：新規鉄道建設前の実態把握と建設後の影響評価

期間：2012年4月～2015年3月

代表者：伊藤健彦

1.4 Exchange Programs

(1) International Joint Research

Dynamics of drought memory

Period: Apr. 2008–Mar. 2013

Leader: M. Shinoda, ALRC Tottori University

Organization: ALRC, Tottori University (M. Shinoda); Barayev Kazakh Research Institute of Grain Farming; Institute for Meteorology and Hydrology, Mongolia

Funding: JSPS Grant-in-Aid for Scientific Research (A)

Subject: Recently, there has been a worldwide trend for intensified drought. Furthermore, in general, projections of climate models have suggested that the frequency and intensity of extreme weathers including droughts will likely increase in the future. Given this background, the present study investigated a series of mechanism of how meteorological drought (below-normal precipitation) affects soil moisture, vegetation and animals and made an assessment of vulnerability of the steppe vegetation in terms of sensitivity and resilience to drought.

Project for the development of wheat breeding materials for sustainable food production

Period: Apr. 2011–Mar. 2016

Leader: T. Ban, Yokohama City University

Organization: Yokohama City University (T. Ban); ALRC, Tottori University (H. Tsujimoto, A.E. Eltayeb); Riken (M. Matsui); JICA Afghanistan Office (M. Osmanzai)

Funding: JST and JICA

Subject: The aim of this project is development of wheat breeding system for sustainable food production in Afghanistan to conserve the local varieties and wild relatives of wheat maximizing their potential as breeding materials for high yield and good quality. In this project we produced a population of Afghanistan landrace, Sephadak Ishkashim, holding the diversity of wheat related wild species, *Ae. tauschii*. The population is cultivated in the experimental field of Afghanistan and will be selected for stress tolerance.

Application of alien genetic resources with high fertilizer efficiency and drought tolerance in dryland wheat breeding

Period: Jan. 2011–Dec. 2013

Leader: S.-W. Wang, Institute of Soil and Water Conservation, Chinese Academy of Science

Organization: Institute of Soil and Water Conservation, Chinese Academy of Science (S.-W. Wang); ALRC, Tottori University (H. Tsujimoto, K. Tanaka)

Funding: Chinese Academy of Science

Subject: Wheat production under dry and less fertilizer condition is a big issue for the present and future agriculture. In this project we evaluate the wheat with the genes of the wild species for drought and less fertilizer-tolerance in condition of the northwest China and apply the result for wheat breeding.

Conservation of great migration of wild mammals in Mongolia: monitoring of current conditions and assessment of new railroad construction

Period: Apr. 2012–Mar. 2015

Leader: T. Ito, ALRC Tottori University

組織：鳥取大学乾燥地研究センター（伊藤健彦）・モンゴル科学アカデミー生物学研究所（B. Lhagvasuren）
研究費：科学研究費補助金 基盤研究（C）
課題：モンゴル南部では大規模鉱山開発に伴う新規鉄道・道路建設が進行中であり、長距離移動をおこなう野生有蹄類への影響が懸念されている。鉄道建設前の現時点での野生動物の移動や生息地選択の実態を衛星追跡や環境のリモートセンシング等から明らかにし、鉄道建設後の影響を評価することを目的としている。

ジャトロファのアソシエーション解析

期間：2012年4月～2013年3月

代表者：井上知恵

組織：INIFAP（A. Zamarripa）・大阪大学（土本卓）・鳥取大学乾燥地研究センター（辻本壽、井上知恵）等
研究費：ポストGCOEプロジェクト・プロジェクト研究員研究費

課題：ジャトロファ（*Jatropha curcas*）は、バイオ燃料植物として乾燥地でも栽培が拡大している非常に有望な植物資源である。ジャトロファの原産地であるメキシコにある国立農牧林業研究所（INIFAP）では、多様なジャトロファの遺伝子源を収集・保有・管理している。本年度は、INIFAPで保有しているジャトロファ系統を用いてアソシエーション解析を行い、種子生産に関わる諸形質に関連するマーカーを調査した。

根寄生雑草克服によるスーダン乾燥地農業開発

期間：2009年6月～2015年3月

代表者：杉本幸裕

組織：神戸大学（杉本幸裕・山内靖雄・鯨島啓彰）・スーダン科学技術大学（A.G.T. Babiker, A.H.E. Hamad）・鳥取大学乾燥地研究センター（井上知恵）等

研究費：地球規模課題対応国際科学技術協力事業経費

課題：根寄生植物ストライガ（*Striga hermonthica*）は、ソルガムやパールミレットなどのイネ科の主要作物に寄生することから、アフリカの乾燥地で主要作物の収量低下の最も大きな生物学的要因となっている。本プロジェクトで、私は小課題“宿主養水分収奪機構の解析”を担当し、土壌乾燥条件下でのストライガと宿主ソルガムの光合成特性や気孔応答について共同研究を行っている。

ストライガ低感受性ソルガムの抵抗性・耐性機構の解明

期間：2011年4月～2014年3月

代表者：杉本幸裕

組織：神戸大学（杉本幸裕）・鳥取大学乾燥地研究センター（井上知恵）

研究費：科学研究費補助金 基盤研究（B）（海外）

課題：根寄生雑草ストライガの宿主作物への被害は土壌乾燥条件下でより深刻である。本プロジェクトでは、異なる土壌水分条件下でストライガが宿主であるソルガムから養水分を収奪する過程における植物ホルモンのアブシジン酸の影響と同化産物の転流・分配について調査を行っている。

Organization: ALRC, Tottori University (T. Ito); Institute of Biology, Mongolian Academy of Sciences (B. Lhagvasuren)

Funding: JSPS Grants-in-Aid for Scientific Research (C)

Subject: Influence by construction of new railroad and roads to permit big mining project in south Mongolia on wild mammals moving long distances is concerned. This project aims to monitor current situation of movements and habitat selection of wild mammals by using satellite tracking and remote sensing etc. and to assess influences after the railroad construction.

Association mapping on *Jatropha curcas*

Period: Apr. 2012–Mar. 2013

Leader: T. Inoue, ALRC Tottori University

Organization: INIFAP (A. Zamarripa); Osaka University (S. Tsuchimoto); ALRC, Tottori University (H. Tsujimoto, T. Inoue) et al.

Funding: Post GCOE project

Subject: *Jatropha curcas*, originated in Mexico, is a promising source of bioenergy, and currently widely cultivated in dry areas. INIFAP, Mexico, has collected various *J. curcas* accessions from different regions in Mexico. Molecular markers associated inflorescence, fruit and seed traits in *J. curcas* were investigated using the INIFAP accessions.

Improvement of food security in semi-arid regions of Sudan through management of root parasitic weeds

Period: Jun. 2009–Mar. 2015

Leader: Y. Sugimoto, Kobe University

Organization: Kobe University (Y. Sugimoto, Y. Yamauchi, H. Samejima); Sudan University of Science and Technology (A.G.T. Babiker, A.H.E. Hamad); ALRC, Tottori University (T. Inoue) et al.

Funding: JICA-JST SATREPS

Subject: Root hemi-parasite *Striga hermonthica* parasitizes gramineous plants, including sorghum and pearl millet, so that the most serious biotic constraint on crop production in the dry areas of Africa. In this project, I have conducted joint research on photosynthetic capacity and stomatal responses in *S. hermonthica* and host sorghum under different water regimes.

Mechanisms of resistance and tolerance to *Striga* infection in *Striga*-insensitive sorghum genotypes

Period: Apr. 2011–Mar. 2014

Leader: Y. Sugimoto, Kobe University

Organization: Kobe University (Y. Sugimoto); ALRC, Tottori University (T. Inoue)

Funding: JSPS Grant-in-Aid for Scientific Research (B)

Subject: Damage of root-parasitic weed *Striga hermonthica* on crops is more serious under drought. In this project, I have studied on translocation of assimilates and effect of abscisic acid on water and solute flow from sorghum host to the parasite.

(2) 海外出張・研修

篠田 雅人

モンゴル (2012年4月23日~28日)

「黄砂プロジェクトに係る研究打合せ」

黄砂プロジェクト経費

モンゴル (2012年8月19日~23日)

「モンゴル高原とその周辺地域における環境と持続可能な開発に関する第8回国際会議に出席」

科学研究費補助金B

中華人民共和国 (2012年9月6日~14日)

「中国内モンゴル自治区シリンhot周辺現状視察」

グローバル COE プログラム経費

木村 玲二

エジプト (2012年9月2日~14日)

「現地灌漑農地等の調査、研究打合せおよびシンポジウム参加」

運営費交付金

安田 裕

スーダン (2012年6月8日~15日)

「乾燥地における植生と地下水文系との関連に関する現地調査」

総合地球環境学研究所経費

スウェーデン (2012年7月1日~15日)

「乾燥環境下での非均一土壌中の移動現象についての共同研究」

私費

スウェーデン (2012年7月29日~8月24日)

「乾燥環境下での非均一土壌中の移動現象についての共同研究」

私費

黒崎 泰典

モンゴル (2012年4月22日~28日)

「黄砂プロジェクトに係る研究打合せ」

黄砂プロジェクト経費

モンゴル (2012年7月22日~9月25日)

「組織的な若手研究者等海外派遣プログラムに係る派遣のため」

組織的な若手研究者等海外派遣プログラム経費

モンゴル (2013年3月15日~26日)

「追加設置される太陽光発電システムの検収のため」

黄砂プロジェクト経費

辻本 壽

グルジア国 (2012年7月10日~22日)

「研究課題に関するムギ類植物遺伝資源に関する学術調査のため」

岡山大学経費 (科研費補助金)

カザフスタン共和国 (2012年7月26日~8月1日)

「研究課題に関するムギ類植物遺伝資源に関する学術調査のため」

岡山大学経費 (科研費補助金)

アメリカ合衆国 (2012年10月28日~11月2日)

「組織的な若手研究者等海外派遣プログラムに係る派

(2) Researchers' Travels Abroad

Shinoda, Masato

Mongolia (Apr. 23-28, 2012)

'Meeting on the dust project'

Funded by Project Asian Dust

Mongolia (Aug. 19-23, 2012)

'Participation of the Eighth International Conference on Environment and Sustainable Development in Mongolian Plateau and Surrounding Regions'

Funded by Grant-in-Aid for Scientific Research B

China (Sep. 6-14, 2012)

'Field survey of Xilinhote in inner Mongolia of China'

Funded by Global COE program

Kimura, Reiji

Arab Republic of Egypt (Sep. 2-14, 2012)

'Field survey on the irrigated farmland in Dakhla oasis, meeting, and presentation at the symposium in Cairo'

Funded by Cooperative Research Program of ALRC

Yasuda, Hiroshi

The republic of Sudan (Jun. 8-15, 2012)

'Field survey on interaction between vegetation and sub-surface hydrological system'

Funded by the Institute of Human and Nature

Swedish Kingdom (Jul. 1-15, 2012)

'Cooperation research on transport in heterogeneous soil in arid environments'

Private funds

Swedish Kingdom (Jul. 29-Aug. 24, 2012)

'Cooperation research on transport in heterogeneous soil in arid environments'

Private funds

Kurosaki, Yasunori

Mongolia (Apr. 22-28, 2012)

'A meeting about Project Asian Dust'

Funded by Project Asian Dust

Mongolia (Jul. 22-Sep. 25, 2012)

'For a visit under JSPS Institutional Program for Young Researcher Overseas Visits'

Funded by Institutional Program for Young Researcher Overseas Visits

Mongolia (Mar. 15-26, 2013)

'For an inspection of the additionally installed solar photovoltaic system'

Funded by Project Asian Dust

Tsujimoto, Hisashi

Georgia (Jul. 10-22, 2012)

'Academic investigation on the germplasms of wheat, barley and the related species'

Funded by Okayama University

Kazakhstan (Jul. 26-Aug. 1, 2012)

'Academic investigation on the germplasms of wheat, barley and the related species'

Funded by Okayama University

United State of America (Oct. 28-Nov. 2, 2012)

'Project for JSPS-Institutional Program for Young Researchers Overseas Visits'

遣のため」

組織的な若手研究者等海外派遣プログラム経費
アフガニスタン国 (2012年10月9日～21日)
「持続的食糧生産のためのコムギ育種素材開発プロジェクトに係る派遣のため」
横浜市立大学経費
トルコ (2013年1月22日～27日)
「持続的食糧生産のためのコムギ育種素材開発プロジェクトに係る派遣のため」
横浜市立大学経費
中華人民共和国 (2013年3月18日～24日)
「ITPに係る ICDD 参加及び発表、パートナー機関との協議のため」
JSPS 若手インターナショナルトレーニングプログラム経費

恒川 篤史

中華人民共和国 (2012年4月6日～12日)
「黄砂に関するフィールド調査のため」
黄砂プロジェクト経費
チュニジア (2012年10月31日～11月8日)
「MS プログラムコースワーク実施及び在チュニジア日本領事館訪問のため」
JSPS 若手インターナショナルトレーニングプログラム経費
中華人民共和国 (2013年1月8日～13日)
「ITPに係るディフェンス及びMS プログラム委員会出席のため」
JSPS 若手インターナショナルトレーニングプログラム経費
中華人民共和国 (2013年3月18日～24日)
「ITPに係る ICDD 参加及び発表、パートナー機関との協議のため」
JSPS 若手インターナショナルトレーニングプログラム経費

安 萍

中華人民共和国 (2012年7月3日～15日)
「セミナーに参加および実験場視察、現地調査」
奨学寄附金
ナイジェリア (2012年9月3日～13日)
「研究打合せおよび農地視察」
奨学寄附金

坪 充

中華人民共和国 (2012年4月6日～12日)
「黄砂に関するフィールド調査のため」
黄砂プロジェクト経費
南アフリカ (2012年7月15日～8月5日)
「学会参加、植物生産モデルに関する研究打合せおよびデータ・資料収集、干ばつ早期警戒システムに関するデータ・資料収集および研究打合せ」
黄砂プロジェクト経費

Eltayeb Habora, Amin Elsadig

アメリカ合衆国 (2012年6月15日～2013年1月15日)

Funded by JSPS-Institutional Program for Young Researchers Overseas Visits Program
Afghanistan (Oct. 9–21, 2012)
‘Project for the development of wheat breeding materials for sustainable food production’
Funded by Yokohama City University
Turkey (Jan. 22–27, 2013)
‘Project for the development of wheat breeding materials for sustainable food production’
Funded by Yokohama City University
People’s Republic of China (Mar. 18–24, 2013)
‘Participation and presentation on International conference on development of drylands’
Funded by JSPS International Training Program

Tsunekawa, Atsushi

People’s Republic of China (Apr. 6–12, 2012)
‘Field investigation on Aeolian dust sources’
Funded by Project Asian Dust
Tunisia (Oct. 31–Nov. 8, 2012)
‘Participation in the course work of MS Program and visit to Japanese Embassy in Tunisia’
Funded by JSPS International Training Program
People’s Republic of China (Jan. 8–Jan. 13, 2013)
‘Participation in the defense and Committee meeting of MS Program’
Funded by JSPS International Training Program
People’s Republic of China (Mar. 18–24, 2013)
‘Participation and presentation in the eleventh ICDD, and meeting with partner institutions’
Funded by JSPS International Training Program

An, Ping

People’s Republic of China (Jul. 3–15, 2012)
‘Participation in a seminar and Field survey’
Funded by Company donation
Nigeria (Sep. 3–13, 2012)
‘Research meeting and inspection of farmlands’
Funded by Company donation

Tsubo, Mitsuru

People’s Republic of China (Apr. 6–12, 2012)
‘Field Survey’
Funded by Project Asian Dust
Republic of South Africa (Jul. 15–Aug. 5, 2012)
‘Conference participation, meetings with researchers, and data collection’
Funded by the Asian Dust Project and the university

Eltayeb Habora, Amin Elsadig

United State of America (Jun. 15 2012–Jan. 15, 2013)
‘Project for JSPS Institutional Program for Young Research Overseas Visits’
Funded by JSPS Institutional Program for Young Research Overseas Visits
People’s Republic of China (Mar. 17–22, 2013)
‘Participation on the international the International conference on development of drylands’
Funded by MEXT Grants for Formation of the Outstanding Hub Graduate schools

「組織的な若手研究者等海外派遣プログラムに係る派遣のため」

組織的な若手研究者等海外派遣プログラム

中華人民共和国 (2013年3月17日～22日)

「第11回乾燥地開発国際会議 (ICDD) 出席のため」

卓越大学院補助金

山中 典和

モンゴル (2012年6月9日～13日)

「東アジア砂漠化地域における黄砂発生源対策と人間・環境への影響評価に係る現地調査」

黄砂プロジェクト経費

モンゴル (2012年8月4日～10日)

「乾燥地生態系の構造および空間分布についての解析に係る現地草原生態系調査」

環境省環境研究総合推進費

中華人民共和国 (2012年8月16日～22日)

「平成24年度共同研究プロジェクト推進のための現地調査」

運営費交付金

中華人民共和国 (2012年9月6日～11日)

「黄砂発生源対策に資する日中韓黄砂共同研究実施に向けた現地調査」

環境省業務請負機関経費

中華人民共和国 (2012年10月22日～26日)

「東アジア砂漠化地域における黄砂発生源対策と人間・環境への影響評価に係る現地調査」

黄砂プロジェクト経費

ケニア (2012年11月2日～11日)

「東アジア砂漠化地域における黄砂発生源対策と人間・環境への影響評価に係る現地調査」

黄砂プロジェクト経費

アメリカ合衆国 (2012年12月22日～30日)

「組織的な若手研究者等海外派遣プログラムに係る担当教員派遣のため」

組織的な若手研究者等海外派遣プログラム経費

モンゴル (2013年2月22日～3月1日)

「乾燥地生態系の構造と機能および空間分布についての解析に係る現地調査」

環境省環境研究総合推進費

中華人民共和国 (2013年3月19日～22日)

「ITPに係る ICDD 参加のため」

JSPS 若手インターナショナルトレーニングプログラム経費

藤巻 晴行

エジプト (2012年4月16日～27日)

「ナイル流域における食糧・燃料の持続的生産プロジェクトの研究打合せおよび現地作業のため」

国際協力事業団

エジプト (2012年5月14日～19日)

「ナイル流域における食糧・燃料の持続的生産プロジェクトの研究打合せおよび現地作業のため」

国際協力事業団

チュニジア (2012年5月19日～27日)

「MS プログラムに係る研究指導のため」

Yamanaka, Norikazu

Mongolia (Jun. 9-13, 2012)

‘Research on the control of dust emission’

Funded by Project Asian Dust

Mongolia (Aug. 4-10, 2012)

‘Research on the Biodiversity of dryland ecosystem and sustainability of nomadic production in Northeast Asia’

Funded by the Environment Research and Technology Development Fund, Ministry of the Environment

People’s Republic of China (Aug. 16-22, 2012)

‘Field survey for Cooperative Research Program of ALRC’

Funded by Cooperative Research Program of ALRC

People’s Republic of China (Sep. 6-11, 2012)

‘Participation in the Field survey of DSS WGII’

Funded by the Ministry of the Environment

People’s Republic of China (Oct. 22-26, 2012)

‘Research on the control of dust emission’

Funded by Project Asian Dust

Republic of Kenya (Nov. 2-11, 2012)

‘Research on the control of dust emission’

Funded by Project Asian Dust

United States of America (Dec. 22-30, 2012)

‘Discussion and training on Institutional Program for Young Researcher Overseas Visits Program’

Funded by Institutional Program for Young Researcher Overseas Visits

Mongolia (Feb. 22-Mar. 1, 2013)

‘Research on the Biodiversity of dryland ecosystem and sustainability of nomadic production in Northeast Asia’

Funded by the Environment Research and Technology Development Fund, Ministry of the Environment

People’s Republic of China (Mar. 19-22, 2013)

‘Participation in the 10th International Conference on development of drylands’

Funded by JSPS International Training Program

Fujimaki, Haruyuki

Arab Republic of Egypt (Apr. 16-27, 2012)

‘Research activities on “Sustainable systems for food and bio-energy production with water-saving irrigation in the Egyptian Nile basin”’

Funded by Japan International Cooperation Agency

Arab Republic of Egypt (May 14-19, 2012)

‘Research activities on “Sustainable systems for food and bio-energy production with water-saving irrigation in the Egyptian Nile basin”’

Funded by Japan International Cooperation Agency

Republic of Tunisia (May 19-27, 2012)

‘Supervision of study on MS program’

Funded by JSPS International Training Program

Arab Republic of Egypt (Jul. 2-Aug. 21, 2012)

‘Research activities on “Sustainable systems for food and bio-energy production with water-saving irrigation in the Egyptian Nile basin”’

Funded by Japan International Cooperation Agency

Arab Republic of Egypt (Aug. 30-Sep. 14, 2012)

‘Research activities on “Sustainable systems for food and bio-energy production with water-saving irrigation in the Egyptian Nile basin”’

JSPS 若手インターナショナルトレーニングプログラム経費
 エジプト (2012 年 7 月 2 日～21 日)
 「ナイル流域における食糧・燃料の持続的生産プロジェクトの研究打合せおよび現地作業のため」
 国際協力事業団
 エジプト (2012 年 8 月 30 日～9 月 14 日)
 「ナイル流域における食糧・燃料の持続的生産プロジェクトの研究打合せおよび現地作業のため」
 国際協力事業団
 エジプト (2012 年 10 月 3 日～12 日)
 「ナイル流域における食糧・燃料の持続的生産プロジェクトの研究打合せおよび現地作業のため」
 国際協力事業団
 アメリカ合衆国 (2012 年 10 月 19 日～26 日)
 「アメリカ土壤学会年次大会に参加のため」
 科学技術振興機構経費
 エジプト (2012 年 12 月 17 日～29 日)
 「ナイル流域における食糧・燃料の持続的生産プロジェクトの研究打合せおよび現地作業のため」
 国際協力事業団
 中華人民共和国 (2013 年 1 月 9 日～13 日)
 「ITP に係るディフェンスのため」
 JSPS 若手インターナショナルトレーニングプログラム経費
 エジプト (2013 年 1 月 21 日～27 日)
 「ナイル流域における食糧・燃料の持続的生産プロジェクトの研究打合せおよび現地作業のため」
 国際協力事業団
 エジプト (2013 年 2 月 27 日～3 月 8 日)
 「ナイル流域における食糧・燃料の持続的生産プロジェクトの研究打合せおよび現地作業のため」
 国際協力事業団
 中華人民共和国 (2013 年 3 月 18 日～22 日)
 「ITP に係る ICDD 参加のため」
 JSPS 若手インターナショナルトレーニングプログラム経費

伊藤 健彦

モンゴル (2012 年 7 月 16 日～9 月 14 日)
 「組織的な若手研究者等海外派遣プログラムに係る派遣のため」
 組織的な若手研究者等海外派遣プログラム経費
 モンゴル (2013 年 2 月 22 日～3 月 1 日)
 「研究打合せおよび環境調査」
 科学研究費補助金

谷口 武士

アメリカ合衆国 (2012 年 4 月 1 日～6 日)
 「組織的な若手研究者等海外派遣プログラムに係る派遣のため」
 組織的な若手研究者等海外派遣プログラム経費
 モンゴル (2012 年 7 月 27 日～8 月 8 日)
 「東アジア砂漠化地域における黄砂発生源対策と人間・環境への影響評価に係る現地調査」
 黄砂プロジェクト経費

Funded by Japan International Cooperation Agency
 Arab Republic of Egypt (Oct. 3-12, 2012)
 'Research activities on "Sustainable systems for food and bio-energy production with water-saving irrigation in the Egyptian Nile basin"'
 Funded by Japan International Cooperation Agency
 United State of America (Oct. 19-26, 2012)
 'Participation and presentation on ASA, CSSA, & SSSA 2012 International Annual Meetings'
 Funded by the Japan Science and Technology Agency
 Arab Republic of Egypt (Dec. 17-29, 2012)
 'Research activities on "Sustainable systems for food and bio-energy production with water-saving irrigation in the Egyptian Nile basin"'
 Funded by Japan International Cooperation Agency
 People's Republic of China (Jan. 9-13, 2013)
 'Attendance to defense of ITP program'
 Funded by JSPS International Training Program
 Arab Republic of Egypt (Jan. 21-27, 2012)
 'Research activities on "Sustainable systems for food and bio-energy production with water-saving irrigation in the Egyptian Nile basin"'
 Funded by Japan International Cooperation Agency
 Arab Republic of Egypt (Feb. 27-Mar. 8, 2012)
 'Research activities on "Sustainable systems for food and bio-energy production with water-saving irrigation in the Egyptian Nile basin"'
 Funded by Japan International Cooperation Agency
 People's Republic of China (Mar. 18-22, 2013)
 'Attendance to ICDD for ITP program'
 Funded by JSPS International Training Program

Ito, Takehiko

Mongolia (Jul. 12-Sep. 14, 2012)
 'Visits for Institutional Program for Young Researcher Overseas Visits'
 Funded by Institutional Program for Young Researcher Overseas Visits
 Mongolia (Feb. 22-Mar. 1, 2013)
 'Discussion on the research plan and field survey'
 Funded by JSPS Grants-in-Aid for Scientific Research

Taniguchi, Takeshi

United States of America (Apr. 1-6, 2012)
 'Research and training promoted by Institutional Program for Young Researcher Overseas Visits'
 Funded by Institutional Program for Young Researcher Overseas Visits
 Mongolia (Jul. 27-Aug. 8, 2012)
 'Field survey for Assessment and Control of Dust Emission in Degraded Drylands of East Asia'
 Funded by Project Asian Dust Project
 United States of America (Aug. 20-Oct. 20, 2012)
 'Research and training promoted by Institutional Program for Young Researcher Overseas Visits'
 Funded by Institutional Program for Young Researcher Overseas Visits
 United States of America (Dec. 22-30, 2012)

アメリカ合衆国 (2012年8月20日~10月20日)
「組織的な若手研究者等海外派遣プログラムに係る派遣のため」

組織的な若手研究者等海外派遣プログラム経費

アメリカ合衆国 (2012年12月22日~30日)
「組織的な若手研究者等海外派遣プログラムに係る派遣のため」

組織的な若手研究者等海外派遣プログラム経費

インド (2013年1月5日~13日)
「国際菌根学会への参加及び海岸クロマツ林再生に向けた菌根応用技術に関する情報収集」

科学研究費補助金

アメリカ合衆国 (2013年2月21日~3月9日)
「植物の耐乾性と共生微生物に関する調査、および情報交換」

科学研究費補助金

安藤 孝之

メキシコ (2012年8月15日~10月6日)
「チアパス州内のヤトロファ栽培促進のための施策の調査と課題の分析」

運営費交付金

メキシコ (2013年3月20日~30日)
「研究打合せおよび乾燥地植物研究の調査の為」
卓越大学院補助金

鍋田 肇

メキシコ (2012年11月9日~21日)
「メキシコ海外実践教育プログラムフィールドワーク実施のため」

国際交流センター経費

スーダン (2013年2月22日~3月1日)
「若手研究者の人材育成に関する研究のため」
ポストGCOEプロジェクト経費

エチオピア (2013年3月1日~7日)
「若手研究者の人材育成に関する研究のため」
ポストGCOEプロジェクト経費

中華人民共和国 (2013年3月17日~22日)
「第11回乾燥地開発国際会議 (ICDD) 出席のため」
卓越大学院補助金

留森 寿士

メキシコ (2013年8月1日~10月12日)
「組織的な若手研究者等海外派遣プログラムに係る派遣およびジャトロファ研究のため」

組織的な若手研究者等海外派遣プログラム経費

井上 知恵

スーダン (2012年6月1日~9日)
「スーダン科学技術大学で根寄生雑草ストライガに関する共同研究の実施」

JICA-JST SATREPS 事業経費

イギリス (2012年6月24日~7月1日)
「第8回国際根研究学会出席と研究発表のため」
科学研究費補助金

スーダン (2012年7月24日~8月31日)

‘Research and training promoted by Institutional Program for Young Researcher Overseas Visits’

Funded by Institutional Program for Young Researcher Overseas Visits

India (Jan. 5-13, 2013)

‘Participation in the 7th International Conference on Mycorrhiza, and information collection to apply mycorrhiza for the restoration of coastal pine forests’

Funded by JSPS Grant-in-Aid for Scientific Research

United States of America (Feb. 21-Mar. 9, 2013)

‘Field survey and information collection for research on the relationship between symbiotic microorganisms and stress tolerance of plants’

Funded by JSPS Grants-in-Aid for Young Scientists

Ando, Takayuki

Mexico (Aug. 15-Oct. 6, 2012)

‘Study on the measures and challenges for promotion of *Jatropha* cultivation in the State of Chiapas’

Funded by Cooperative Research Program of ALRC

Mexico (Mar. 20-30, 2013)

‘Discussion and planning for the research on plants in drylands’

Funded by MEXT Grants for Formation of the Outstanding Hub Graduate schools

Nabeta, Hajime

Mexico (Nov. 9-21, 2012)

‘Overseas Practical Education Program Tottori-CIBNOR-UABCS 2012’

Funded by Cooperative Research Program of Center for International Affairs

Sudan (Feb. 22-Mar. 1, 2013)

‘Follow-up study on ex-training-Participants of Governments/JICA/Tottori-university tri-partite cooperation in capacity development on dry-land agricultural technologies’

Funded by Post Global GOE Program

Ethiopia (Mar. 1-7, 2013)

‘Follow-up study on ex-training-Participants of Governments/JICA/Tottori-university tri-partite cooperation in capacity development on dry-land agricultural technologies’

Funded by Post Global COE Program

People’s Republic of China (Mar. 17-22, 2013)

‘11th International Drylands Development Conference (IDDC)’

Funded by MEXT Grants for Formation of the Outstanding Hub Graduate schools

Tomemori, Hisashi

United Mexican States (Aug. 1-Oct. 12, 2012)

‘Research activities on “Institutional Program for Young Researcher Overseas Visits Program” and Studies on Physic nut.’

Funded by the Institutional Program for Young Researcher Overseas Visits

Inoue, Tomoe

Republic of the Sudan (Jun. 1-9, 2012)

‘Conducting joint research on root parasitic weed *Striga*

「スーダン科学技術大学で根寄生雑草ストライガにする共同研究の実施」

JICA-JST SATREPS 事業経費

スーダン (2012年9月20日~28日)

「スーダン科学技術大学で根寄生雑草ストライガに関する共同研究の実施」

JICA-JST SATREPS 事業経費

李 衡峻

韓国 (2012年10月21日~26日)

「第10回日韓学生交流環境セミナーの参加」

鳥取大学工学部経費

趙 晟佑

中国、北京 (2013年3月17日~22日)

「第11回乾燥地開発国際会議 (ICDD) 出席のため」

卓越大学院補助金

立石 麻紀子

中華人民共和国 (2012年8月1日~12日)

「東アジア砂漠化地域における黄砂発生源対策と人間・環境への影響評価に係る現地調査」

黄砂プロジェクト経費

中華人民共和国 (2013年1月6日~15日)

「組織的な若手研究者等海外派遣プログラムに係る派遣のため」

組織的な若手研究者等海外派遣プログラム経費

小池 崇子

モンゴル (2012年8月17日~9月1日)

「ポストグローバル COE プロジェクトに係る研究打合せ・データ収集のため」

運営費交付金

モンゴル (2013年3月11日~21日)

「黄砂プロジェクトに係るモンゴルにおける可搬型 AWS メンテナンスおよびデータ回収のため」

運営費交付金

程 云湘

中国 (2012年9月6日~14日)

「中国内モンゴル自治区シリント周辺現状視察のため」

グローバル COE プログラム経費

Ailijiang Maimaiti

モンゴル (2012年8月4日~14日)

「乾燥地生態系の構造および空間分布についての解析に係る現地草原生態系調査」

環境省環境研究総合推進費

中華人民共和国 (2012年9月20日~10月11日)

「東アジア砂漠化地域における黄砂発生源対策と人間・環境への影響評価に係る現地調査」

黄砂プロジェクト経費

中華人民共和国 (2013年2月9日~3月3日)

「東アジア砂漠化地域における黄砂発生源対策と人間・環境への影響評価に係る現地調査」

hermonthica with scientists at the Sudan University of Science and Technology

Funded by the JICA-JST SATREPS

United Kingdom (Jun. 24-Jul. 1, 2012)

‘Participation and presentation on 8 th International Society of Root Research the international conference’

Funded by JSPS Grant-in-Aid for Scientific Research

Republic of the Sudan (Jul. 24-Aug. 31, 2012)

‘Conducting joint research on root parasitic weed *Striga hermonthica* with scientists at the Sudan University of Science and Technology’

Funded by the JICA-JST SATREPS

Republic of the Sudan (Sep. 20-28, 2012)

‘Conducting joint research on root parasitic weed *Striga hermonthica* with scientists at the Sudan University of Science and Technology’

Funded by the JICA-JST SATREPS

Lee, Hyungjun

South Korea (Oct. 21-26, 2012)

‘Participation 10 th Japan-South Korea Students Exchange Environment seminar’

Funded by Faculty of Engineering, Tottori University

Cho, Seongwoo

People’s Republic of China (Mar. 17-22, 2013)

‘Attendance on 11 th International Conference on Development of Drylands’

Funded by MEXT Grants for Formation of the Outstanding Hub Graduate schools

Tateishi, Makiko

People’s Republic of China (Aug. 1-12, 2012)

‘Research on the control of dust emission’

Funded by Project Asian Dust

Peoples Republic of China (Jan. 6-15, 2013)

‘Visits for Institutional Program for Young Researcher Overseas Visits’

Funded by Institutional Program for Young Researcher Overseas Visits

Koike, Takako

Monolia (Aug. 17-Sep. 1, 2012)

‘To attend research meetings and to collect data for studies of the Post-GCOE Project.’

Funded by Cooperative Research Program of ALRC

Monolia (Mar. 11-21, 2013)

‘To maintain the potable AWSs and to collect data for studies of the Project Asian Dust.’

Funded by Cooperative Research Program of ALRC

Cheng, Yunxiang

People’s Republic of China (Sep. 6-14, 2012)

‘Inspection of the current status of Xilinhot, Inner Mongolia, China’

Funded by Global COE Program

Maimaiti, Ailijiang

Mongolia (Aug. 4-8, 2012)

‘Research on the Biodiversity of dryland ecosystem and

黄砂プロジェクト経費

Meshesha Derege Tsegaye

エチオピア (2012年8月4日~29日)
「現地調査およびデータ収集のため」
運営費交付金

Nandintsetseg Banzragch

モンゴル (2012年4月14日~21日)
「総合的風食スキームのための生態系モデルリングに
関する観測のため」
科学研究費補助金

Ayehu Nigussie Haregeweyn

エチオピア (2012年9月1日~10月9日)
「植生土壌に関するフィールド調査、データ入力および
資料収集」
科学研究費補助金

sustainability of nomadic production in Northeast Asia'
Funded by the Environment Research and Technol-
ogy Development Fund, Ministry of the Environment
People's Republic of China (Sep. 20-Oct. 11, 2012)
'Research on the control of dust emission'
Funded by Project Asian Dust
People's Republic of China (Feb. 9-Mar. 3, 2013)
'Research on the control of dust emission'
Funded by Project Asian Dust

Meshesha, Derege Tsegaye

Ethiopia (Aug. 4-29, 2012)
'Field survey and data collection'
Funded by Cooperative Research Program of ALRC

Nandintsetseg, Banzragch

Mongolia (Apr. 14-21, 2012)
'Observance of Ecosystem Model for Integrated Wind-
erosion Scheme'
Funded by JSPS Grant-in-Aid for Scientific Research

Ayehu, Nigussie Haregeweyn

Ethiopia (Sep.1-Oct. 9, 2012)
'Field survey, date entry and collection on vegetated soil'
Funded by JSPS Grant-in-Aid for Scientific Research

(3) 研究者・受託研究員・研究生の受入れ

研究者

JICA 集団研修 2012 「乾燥地における持続的農業のための土地・水資源の適正管理」(2012年8月20日)

Amarkhail, Lutfullah (アフガニスタン)、Ngueleodai, Joseph (カメルーン)、Eid, Abdelraouf Ramadan (エジプト)、Heyder, Sultan Mohamed (エチオピア)、Abdullah, Mahir Rstam (イラク)、Musa, Baba Usman (ナイジェリア)、Soka, Daniel Zakeyo (南スーダン)、Habibu, Hussein Amiri (タンザニア)、Cheelo, Joseph (ザンビア)、Muzanenhamo, Last Davud (ジンバブエ)、Mohamed, Hussein Ahmed Fadol El Mola (スーダン)、Ejara, Talla Doyyo (エチオピア)

(3) Visiting Researchers, Trainees and Research Students

Researchers

JICA Group Training Course 2012 "Appropriate Management of Land and Water Resources for Sustainable Agriculture in Arid/Semi-arid Regions" (20 Aug. 2012)

Amarkhail, Lutfullah (Afghanistan); Ngueleodai, Joseph (Cameroon); Eid, Abdelraouf Ramadan (Egypt); Heyder, Sultan Mohamed (Ethiopia); Abdullah, Mahir Rstam (Iraq); Musa, Baba Usman (Nigeria); Soka, Leone Daniel Zakeyo (South Sudan); Habibu, Hussein Amiri (Tanzania); Cheelo, Joseph (Zambia); Muzanenhamo, Last David (Zimbabwe); Mohamed, Hussein Ahmed Fadol El Mola (Sudan); Doyyo, Ejara Tolla (Ethiopia)