International Workshop on
Forest Landscape Restoration and Resilience to
Climate Change in Northeast Asia

9 - 13 April 2018 / Beijing & Ordos, China
International Workshop on Forest Landscape Restoration and Resilience to Climate Change in Northeast Asia

9 - 13 April 2018 / Beijing & Ordos, China

[Organized by]
Asia Pacific Association of Forestry Research Institutions
IUFRO Working Party 1.01.13
Editors
Ho Sang Kang, Miin Bang, Tae Hyung Kim

Contributors
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I. Introduction
1. Background

Forests in Asia are unique because of their diverse ecosystems and high biodiversity, and those ecosystems have not only stood at its dignity as itself but also provided essential and valuable services to human beings. Those forest ecosystems, however, has been under enormous pressure of deforestation and forest degradation, induced by both natural factors (i.e., climate change, fire, flood and drought) and anthropogenic factors (i.e., illegal logging, shift cultivation, and over exploitation). Those deforestation and forest degradation have resulted in both environmental damages of soil erosion, land degradation and biodiversity loss and socioeconomic damages of insecure food, water and health, as well as the loss of cultural identity/dignity to the people.

In order to mitigate and combat those challenges in forest sector, international dialogues among various stakeholders have been proceeded for last decades and some agreements/voluntary commitments have been followed such through Bonn Challenge, Aichi targets to the Convention of Biological Diversity, New York Declaration on Forests, REDD+ and Goal No. 15 of Sustainable Development Goals, mostly focusing on forest restoration, sustainable forest management, halting biodiversity loss and combating land degradation. Largely complementing those foci, Forest and Landscape Restoration (FLR), defined and understood as the process of regaining ecological functionality and enhancing human wellbeing across cleared or degraded forest landscapes through promoting large-scale and mosaic restorations, is expected to (i) transform the large areas of degraded and deforested land into resilient, multifunctional assets that can contribute to local and national economies, (ii) sequester significant amounts of carbon, (iii) strengthen food and clean water supplies, and (iv) safeguard biodiversity (IUCN & WRI, 2014).

Indeed, FLR is increasingly being considered in international and national strategies to be one of the effective approaches that can contribute to sustainable forest management as well as sustainable development of human beings, in terms of its possibility to yield a number of economic, social and environmental benefits. The FLR approach has already adopted at the regional level in Asia, which includes the countries of China, DPR of Korea, Mongolia and Republic of Korea, and those countries raised the necessity of holistic approach to forest/land restoration and management considering together with the resilience to natural disaster and socioeconomic stability.

Upon this background, this project convenes the international workshop in Beijing and Ordos, China, inviting the experts from China, DPR of Korea, Mongolia, Republic of Korea, as well as international organizations, i.e. FAO, IUFRO, ICRAF, GEF, GCF and AFoCO to discuss the current status, challenges and future alternatives on FLR and the derived topics such as agroforestry and resilience. Furthermore, the major output of this workshop, as a result of presentations by DPR of Korea on current policy in forest sector and the discussion session, would be the Concept Note for Project Concept Paper (PCP) on FLR project to be implemented in DPR of Korea sponsored by international organizations i.e. FAO and/or IUFRO.
2. Objectives

The objectives are:

- To share and understand the current status of deforestation and land degradation, and challenges in forest restoration and resilience to climate change in Northeast Asian region;
- To share and understand the FLRM initiated by FAO;
- To share the up-to-date information and recent policy of DPR of Korea on reforestation, agroforestry, seeds/seedling production, control of land sliding and sloping land management etc.;
- To make the project concept paper (PCP) on reforestation, agroforestry projects to be implemented in DPR of Korea sponsored by FAO and/or IUFRO, NGOs; and
- To conduct field excursion to GEF project and plantation sites (*Hippophae rhamnoides*) in Ordos, Inner Mongolia.

3. Date/Venue

April 9-13, 2018 / Beijing (workshop) and Ordos (field excursion), China

4. Program

<table>
<thead>
<tr>
<th>Time</th>
<th>Program</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 April</td>
<td>Arrival at Beijing Capital Airport</td>
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<tr>
<td>10 April</td>
<td><strong>Workshop</strong></td>
<td><strong>Moderator: Dr. Ho Sang Kang (IUFRO)</strong></td>
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<tr>
<td>08:30-09:00</td>
<td>Registration</td>
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<tr>
<td>09:00-09:05</td>
<td>Welcome Address</td>
<td>Dr. Shirong Liu (Vice President of the Chinese Academy of Forestry(CAF)/IUFRO Board Member)</td>
</tr>
<tr>
<td>09:05-09:10</td>
<td>Congratulatory Remark</td>
<td>Mr. Kwang Chun Ryu (Director, General Bureau of Forestry, MoLEP)</td>
</tr>
<tr>
<td>09:10-09:15</td>
<td>Congratulatory Remark</td>
<td>Dr. Hyun Park (Director, Global Forestry Research Division, NIFoS)</td>
</tr>
<tr>
<td>09:15-09:30</td>
<td>Group photo</td>
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<tr>
<td></td>
<td><strong>Session 1. Forest and Landscape Restoration Mechanism</strong></td>
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<tr>
<td>09:30-10:00</td>
<td>Achievements and the way forward of FLR Mechanism</td>
<td>Dr. Song Hee Nam (Senior Forestry Officer, FAO Headquarter)</td>
</tr>
<tr>
<td>10:00-10:30</td>
<td>The prospect of finance and resource mobilization for FLRM</td>
<td>Ms. Mathilde Iweins (FAO Beijing Office)</td>
</tr>
<tr>
<td>10:30-11:00</td>
<td>Q&amp;A / Discussion</td>
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<tr>
<td>11:00-13:00</td>
<td>Lunch</td>
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<tr>
<td></td>
<td><strong>Session 2. Reforestation and Agroforestry</strong></td>
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<tr>
<td>13:00-13:30</td>
<td>China-GEF Partnership on Land Degradation in Dryland Ecosystems:</td>
<td>Dr. Zengming Song (GEF project manager, CAF)</td>
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<tr>
<td>Time</td>
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<td>Speaker</td>
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<tr>
<td>13:30-14:00</td>
<td>Sustainable and Climate Resilient Land Management in Western PRC</td>
<td>Mr. Kwang Nam Hwang (Senior Officer, General Bureau of Forestry, MoLEP)</td>
</tr>
<tr>
<td>14:00-14:30</td>
<td>Forest Restoration Campaign in DPR Korea</td>
<td>Dr. Hyun Park (Director, NIFoS)</td>
</tr>
<tr>
<td>14:30-15:00</td>
<td>Lessons Learned from Successful Forest Greening in the Republic of Korea</td>
<td>Prof. Jeong Bin Im (Professor, SNU)</td>
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<tr>
<td>15:00-15:30</td>
<td>Situation of Agriculture and Government Policy for Agricultural Development in ROK</td>
<td>Mr. Song Hwan Ryom (Senior Officer, General Bureau of Forestry, MoLEP)</td>
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<tr>
<td>15:30-16:00</td>
<td>Coffee Break</td>
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<tr>
<td>16:00-16:30</td>
<td>Erosion Control Works and Rehabilitation Examples of Landslide Damage in ROK</td>
<td>Dr. Sang Ho Lee (Director, Korean Association of Soil and Water Conservation)</td>
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<tr>
<td>16:30-17:00</td>
<td>Introducing Status and Prospect of Agroforestry Management in DPRK</td>
<td>Mr. Song Hwan Ryom (Senior Officer, General Bureau of Forestry, MoLEP)</td>
</tr>
<tr>
<td>17:00-17:30</td>
<td>Main Forest Pests and Control Measures in DPR Korea</td>
<td>Mr. Yong Il Pak (Director of Forest Breeding Research Institute, Academy of Forest Sciences)</td>
</tr>
<tr>
<td>17:30-18:00</td>
<td>Prediction of Forest Fire Danger Rating (FFDR) in DPRK</td>
<td>Dr. Myoung Soo Won (Senior Researcher, NIFoS)</td>
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<tr>
<td>18:00-19:00</td>
<td>Q&amp;A / Wrap-up</td>
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<tr>
<td>11 April</td>
<td>Planning Workshop on Agroforestry / FLRM</td>
<td>Moderator: Dr. Ho Sang Kang</td>
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<tr>
<td>09:00-09:30</td>
<td>Outlook on Propagation, Cultivation and Prospection for Introduction of Vitamin Tree No.4 at the Northern Areas of Ryanggang Province in DPR Korea</td>
<td>Mr. Yong Hun Ri (Researcher of Afforestation Research Institute, Academy of Forest Sciences)</td>
</tr>
<tr>
<td>10:00-10:30</td>
<td>Breeding and Use of 1st Generation Hybrid of Key Species for Reforestation in DPR Korea</td>
<td>Mr. Kwang Il Pok (Officer of External Economic Cooperation Department, MoLEP)</td>
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<tr>
<td>10:30-12:00</td>
<td>DISCUSSION</td>
<td>- Dr. Hyun Park (Director, NIFoS)</td>
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<td></td>
<td></td>
<td>- Dr. Song Hee Nam (Senior Forestry Officer, FAO Headquarter)</td>
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<td></td>
<td></td>
<td>- Mr. Kwang Chun Ryu (Director, External Cooperation Department, General Bureau of Forestry, MoLEP, DPR of Korea)</td>
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<td></td>
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<td>- Mr. Chang Mo Kang (Deputy Director, Korea Forest Service)</td>
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<td>- Ms. Seung Soon Kim (Activist, Forest for Life)</td>
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<td></td>
<td>- Dr. Ho Joong Yi (Executive Secretary, Agriculture and Fisheries Policy Forum)</td>
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<tr>
<td>12:00-13:30</td>
<td>Lunch &amp; Packing for Departure to Ordos</td>
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<tr>
<td>Time</td>
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<tr>
<td>13:30-14:30</td>
<td>Move to Nanyuan Airport</td>
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<td>15:50-17:20</td>
<td>(KN 5308)</td>
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<tr>
<td>18:00-18:20</td>
<td>Arrival at Wulan International Hotel &amp; Check-in</td>
<td>Wulan International Hotel</td>
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<tr>
<td>18:20-20:00</td>
<td>Dinner</td>
<td>Wulan International Hotel</td>
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<tr>
<td>12 April</td>
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<tr>
<td>08:30-10:00</td>
<td>Move to Hippophae Industry Factory</td>
<td>(Minibus)</td>
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<tr>
<td>10:00-11:00</td>
<td>Visit to Hippophae rhamnoides seedling nurturing</td>
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<td>Visit Hippophae seedling storage site, learn about moisture keeping methods</td>
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<tr>
<td>11:00-12:30</td>
<td>Visit to Hippophae rhamnoides plantation site in ex-mining restoration areas</td>
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<td>12:30-13:10</td>
<td>Move to lunch place</td>
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<td>13:10-14:00</td>
<td>Lunch</td>
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<tr>
<td>14:00-15:30</td>
<td>Move to Qingyan technology center of Salix cheilophila industry</td>
<td>(Minibus)</td>
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<tr>
<td>15:30-17:00</td>
<td>Visit Qingyan processing site of Salix cheilophila products</td>
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<tr>
<td></td>
<td>Visit processing site of Salix products in Qingyan technology center of Salix industry</td>
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<tr>
<td>17:00-17:30</td>
<td>Visit Salix cheilophila plantation site</td>
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<tr>
<td>17:30-18:00</td>
<td>Move back to Wulan International Hotel</td>
<td>(Minibus)</td>
</tr>
<tr>
<td>18:00-20:00</td>
<td>Farewell Dinner</td>
<td>Wulan International Hotel</td>
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<tr>
<td>13 April</td>
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<tr>
<td>07:40-08:00</td>
<td>Check-out</td>
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<tr>
<td>08:00-08:30</td>
<td>Move to Ordos Airport</td>
<td>(Minibus)</td>
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<td>13 April</td>
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<td>07:40-08:00</td>
<td>Check-out</td>
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<tr>
<td>08:00-08:30</td>
<td>Move to Ordos Airport</td>
<td>(Minibus)</td>
</tr>
<tr>
<td>13 April</td>
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</tbody>
</table>

※ Accommodation:

- Beijing (Jianguo Garden Hotel, 北京建国门内大街17号 no.17 jianwuomei Avenue,Beijing,100005)
- Ordos (Wulan International Hotel 乌兰国际大酒店, Inner Mongolia, Ordos, Ejin Horo, Wulanmulun St.)
### 5. List of Participants

<table>
<thead>
<tr>
<th>No.</th>
<th>Country</th>
<th>Name</th>
<th>Position, Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>Dr. Shirong Liu</td>
<td>Vice President of the Chinese Academy of Forestry</td>
</tr>
<tr>
<td>2</td>
<td>China</td>
<td>Dr. Zengming Song</td>
<td>GEF Project Manager</td>
</tr>
<tr>
<td>3</td>
<td>China</td>
<td>Dr. Yong Huan Jin</td>
<td>Associate Professor, Institute of Applied Ecology, CAS</td>
</tr>
<tr>
<td>4</td>
<td>DPR of Korea</td>
<td>Mr. Kwang Chun Ryu</td>
<td>Director of External Cooperation Department, General Bureau of Forestry, Ministry of Land and Environment Protection (MoLEP)</td>
</tr>
<tr>
<td>5</td>
<td>DPR of Korea</td>
<td>Mr. Kwang Nam Hwang</td>
<td>Senior Officer of Science and Technology Department, General Bureau of Forestry, MoLEP</td>
</tr>
<tr>
<td>6</td>
<td>DPR of Korea</td>
<td>Mr. Ryom Song Hwan</td>
<td>Senior Officer of Afforestation Department, General Bureau of Forestry, MoLEP</td>
</tr>
<tr>
<td>7</td>
<td>DPR of Korea</td>
<td>Mr. Pak Yong II</td>
<td>Director of Forest Breeding Research Institute, Academy of Forest Sciences</td>
</tr>
<tr>
<td>8</td>
<td>DPR of Korea</td>
<td>Mr. Ri Yong Hun</td>
<td>Researcher of Afforestation Research Institute, Academy of Forest Sciences</td>
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<td>DPR of Korea</td>
<td>Mr. Pok Kwang Il</td>
<td>Officer of External Economic Cooperation Department, MoLEP</td>
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<tr>
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<td>Mr. Chang Mo Kang</td>
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<td>Republic of Korea</td>
<td>Prof. Jeong Bin Im</td>
<td>Professor, Seoul National University</td>
</tr>
<tr>
<td>12</td>
<td>Republic of Korea</td>
<td>Dr. Hyun Park</td>
<td>Director, NIFoS</td>
</tr>
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<td>Republic of Korea</td>
<td>Dr. Myoung Soo Won</td>
<td>Senior Researcher, NIFoS</td>
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<td>Activist, Forest for Life (NGO)</td>
</tr>
<tr>
<td>17</td>
<td>Republic of Korea</td>
<td>Mr. Tae Hyung Kim</td>
<td>Photographer, Seoul National University</td>
</tr>
<tr>
<td>18</td>
<td>Republic of Korea</td>
<td>Ms. Miin Bang</td>
<td>Researcher, Seoul National University</td>
</tr>
<tr>
<td>19</td>
<td>International</td>
<td>Dr. Song Hee Nam</td>
<td>Senior Forestry Officer, FAO Headquarter</td>
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<tr>
<td>20</td>
<td>Organizations</td>
<td>Ms. Mathilde Marchisio</td>
<td>FAO Consultant on FLRM finance</td>
</tr>
<tr>
<td>21</td>
<td>International</td>
<td>Dr. Ho Sang Kang</td>
<td>Deputy Coordinator, IUFRO Working Party 1.01.13</td>
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II. Presentations
1) Achievements and the Way Forward of FLR Mechanism

Dr. Song Hee Nam
Senior Forestry Officer, FAO Headquarter
FLR Mechanism: Achievements & way forward

Contents

1. Concept, Principles and Key issues of Forest and Landscape Restoration
2. Implementation of the FLR Mechanism at a glance
3. Achievements of implementation of the FLR Mechanism
4. The way forward
1. Concept, Principles and Key issues of Forest and Landscape Restoration

1-1. Definition of *Forest and Landscape* Restoration (FLR)

*(FLR)* “An active process that brings people together to identify, negotiate and implement practices that restore an agreed optimal balance of the ecological, social and economic benefits of forests and trees within a broader pattern of land use” —GPFLR

*(Land degradation)* “Persistent decline” in the provision of goods and services that an ecosystem provides, including biological and water related goods and services as well as land-related social and economic goods and services (FAO/LAD).  
*(Forest degradation)* Reduction of the capacity of a forest to provide goods and services (FAO, 2011).
1-2. Global FLR Initiatives

- **Global Forest Restore Lodge**
  - Restore 150 million ha by 2020

- **Communities & Biocultural Diversity**
  - Alcibi Target 15
  - Restore 15% of Ecosystems by 2020

- **Climate Forests Alliance**
  - NYDF 5
  - Additional 200 million ha by 2030

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1-3. Principles of FLR Planning

**A. Flexibility in planning** to thematic needs and specific local conditions

**B. Phased process** of FLR
- Identification and analysis of the agents and drivers of degradation
- Build up enabling environment, institutional setting and capacity development
- Establish pilot project sites
- Scale up restoration

**C. Integrated land-use** restoration (community-based landscape planning, inter-sectoral cooperation, management of land use and tenure, and improved policies)

**D. Mosaic approaches** to restoration
A. Flexibility of FLR Planning

Flexibility in planning and implementation of FLR in context of purposes, scale, temporal, and conditions

- Single objective
- Multi combined objectives
- Cross sectoral objectives

B. Phased process of FLR

1. Identification and analysis of agents and drivers of degradations
2. Create enabling environment and support institutional and operation mechanism (preparation of FLR National Action Plan)
3. Establish pilot models and large-scale implementation of FLR by supporting finance and resource mobilization
4. Monitor the FLR efforts and disseminate the best practices
C. Mosaic approaches to restoration

Up to 2 billion hectares of deforested and degraded land – size of South America

D. Integrated land-use Management
Case 1. How can we plan Mosaic Restoration in this site?

Photo source: GPFLR

Case 2. How can we plan Mosaic Restoration in this site?
Case 3. The Traditional Restoration Method for Forest

Photo source: KFS

Case 4. Restoration for Forest? Restoration for Forest & Landscape?

Photo source: DPRK
1-4. Key issues to address FLR planning and implementation

2. Implementation of the FLR Mechanism at a glance
2.1. Overview of Implementation of FLR Mechanism

- **Goal**: to support the planning, funding and implementation of FLR at the global, regional and country level

- **Fund**

- **Work frame**
  - FLR Mechanism team - target country (consultant)
  - Advisory group – Partnership in close collaboration with partners

2-2. ROK Funding as a seed money for FLR

**The success factors in ROK**

- A strong leadership and national priority
- Intersectoral cooperation and among government agencies
- Community voluntary participation
- Comprehensive rural development
2.3. Components of FLR Mechanism Implementation by FAO

- Lead global initiatives with other partners, create common guidelines, organize capacity development, capitalize knowledge, get finance and mobilization, and monitor FLR efforts.
- Support regional initiatives, organizations of events, facilitation of regional agenda and strategies and dissemination of knowledge in the decentralized process.
- Support institutional and operational work frame, enabling environment, sustainable financing, demonstration of pilot projects and implementation at large-scale in beneficiary country.
- Establish pilot site with innovative models replicable to other regions, develop technical and practical skills and monitor FLR efforts.

3. Achievements of the FLR Mechanism at global, regional and country levels
3.1. Key achievements at the global level

- FLR Mechanism team and Advisory group was established in the end of 2014
- The FLRM created multiple partners and synergies with various range of organizations
- The FLRM organized and participated in global and regional level events for advocating FLR during key meetings, high-level events, side events and workshops on FLR
- The FLRM regularly updates FLRM newsletter and good practice factsheets to develop capacity
- Infrastructure for a global FLR knowledge platform was established and webinars and on-line Community of Practice are organized
- Guideline documents on FLR monitoring roadmap and local finance prepared and are under review
- The global finance and resource mobilization is ready to open in 2018 to expand more countries

3.2. Key achievements in the regional level

The launch of two new regional initiatives on FLR in the Asia – Pacific region and the Mediterranean region

The Agadir Commitment: to restore 8 million ha by 2030
3.2. Key achievements in the regional level

- The FLRM also supported with a leading role the launch of two new regional initiatives on:
  - Forest and Landscape Restoration in the Asia-Pacific region and the Mediterranean region
  - The Asia-Pacific region: Endorsement of an Asia-Pacific Strategy and Action Plan on FLR
  - The Mediterranean region: Launch of a new regional initiative on FLR during the Fifth Mediterranean Forest Week
- The FLRM also played a key role as a technical partner in Latin America (Initiative 20x20) and Africa (AFR100) on FLR
  - AFR100 - the African Forest Landscape Restoration Initiative: a country-led effort to bring 100 million ha of deforested and degraded landscapes across Africa into restoration by 2030.
3.3. Key achievements at the country level

- The FLRM selected 7 target countries at the 1st phase and is supporting the implementation of FLR
- Cambodia: Preparation of FERI project, site selection with ROAM, Capacity Development
- Philippines: Preparation of IPI project, preparation of pilot actions, National FLR plan
- Lebanon: Operationalization of National Forest Fund, FERI project, IPI project, technical assistant
- Rwanda: Facilitation of cross-sector platform for agroforest and natural resources management
- Uganda: FIP project proposal, the Tree Fund proposal and Watersheds pilot activities
- Guatemala: Preparation of regulation of the law PROBOSQUE, technical support on agroforestry
- Peru: Preparation of National FLR plan, country-wide mapping, selection of FLR sites

Forest Ecosystem Restoration Initiative (FERI) developed by the KFS in cooperation with CBO

4. The Way forward
4.1. Expand implementation of FLR at large-scale

(Funding) 6,598,962 USD → 69,096,962 USD

(Country) 8 countries → 26 countries

<table>
<thead>
<tr>
<th>Donor</th>
<th>Period</th>
<th>Budget</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>KFS</td>
<td>2014-2020</td>
<td>3,598,962 USD</td>
<td>Cambodia, Guatemala, Lebanon, Peru, the Philippines, Rwanda, and Uganda, DPRK</td>
</tr>
<tr>
<td>SIDA</td>
<td>2015-2017</td>
<td>3,000,000 USD</td>
<td>Burkin Faso, Niger (3 villages)</td>
</tr>
<tr>
<td>FFEM</td>
<td>2018-2020</td>
<td>2,000,000 USD</td>
<td>Ethiopia, Fiji, Lebanon, Morocco, Niger, the Philippines</td>
</tr>
<tr>
<td>IKI</td>
<td></td>
<td>5,400,000 USD</td>
<td>FAO Central African Republic (CAR), Democratic Republic of the Congo (DRC), Sao Tome, Kenya, Pakistan</td>
</tr>
<tr>
<td>GEF-6</td>
<td></td>
<td>54,000,000 USD</td>
<td>IUCN China, Cameroon, Guinea Bissau, Myanmar, UNEP Tanzania, Kenya</td>
</tr>
</tbody>
</table>

Target Countries for implementation of FLR on a map
4.2. Challenges to be overcome

1) To update the logical framework of the FLRM in a changed environment
   - It's time to make post-2020 recommendations both regarding human and
     financial resources to maintain and follow up the outcomes and impacts of FLRM.

2) To improve knowledge and methodology on FLR monitoring
   - Monitoring methodology including goals and impact, a set of indicators and metrics
     indication is an urgent work for better management of FLR, evaluation of success or
     failures before investing scaling up and taking accountability to stakeholders.

3) To increase more finance and resource mobilization to expand at large-scale
   implementation of FLR through creating the global issues and events.

THANK YOU
2) The Prospect of Finance and Resource Mobilization of FLRM

Ms. Mathilde Iweins
Consultant, FAO Beijing Office
Resource mobilization for FLR
the FLRM example

Mathilde Iweins, FAO
Resources mobilization for FLRM

Perspectives for FLR: Projects about to start with the FLRM

- Forest and Landscape Restoration & Sustainable Land Management in Sahel (Burkina Faso and Niger) – French GEF (US$ 2 M)

- The Paris Agreement in action: scaling up Forest and Landscape Restoration (FLR) in the context of the Bonn Challenge to achieve the NDCs by promoting joint mitigation and adaptation approaches in Africa, Pacific Islands and the Mediterranean – IKI Germany (US$ 5.3 M)

- The Restoration Initiative (FAO, UNEP, IUCN) – GEF (US$ 54 M)
Goal
Incentivize stakeholders to restore/sustainably manage sahelian land to ensure ecosystem services provision on the long term and participate to the Land Degradation Neutrality objective.

Geography
National (Burkina Faso & Niger), Regional (Sahel), Global

Timeline
2018-2021

Components and Partners

- Implementation of FLR/SLM policies through innovative/participatory planning, implementation and monitoring at communal level
  Implementing partners: National and GGWISS Agencies, UNCDF, Agrhymet

- National and regional capacity building on land use monitoring and evaluation & Knowledge development and sharing at regional level
  Implementing Partners: Agrhymet

- Integration of sahelian partners in global FLR initiative and resources mobilization & program coordination
FLRM & SLM in Sahel (Burkina Faso and Niger)
French GEF (1.8 M€/ US$2 M)

Highlights of the program

✓ 3 levels of intervention to generate virtuous circles
✓ Promoting Packages of Practices decided in participative way
✓ Local Development Funds integrating FLR/SLM
✓ FLR resource Mobilization (private sources)

FLR & Bonn Challenge & Paris Agreement
IKI (4.8 M€/ US$ 5.3 M)

Goal
Scaling up Forest and Landscape Restoration (FLR) in the context of the Bonn Challenge to achieve the NDCs by promoting joint mitigation and adaptation approaches in Africa, Pacific Islands and the Mediterranean.

Geography
Asia Pacific Islands (focus: Fiji, Philippines), Africa/Great Green Wall (focus: Niger, Ethiopia), Mediterranean (focus: Morocco, Lebanon)

Timeline
2018-2022
Components (1/2)

Large scale national FLR programmes promoted

- enabling environment created for implementation of national FLR programmes and scale up through inter sectoral coordination and relevant policy;
- restoration approaches and technologies implemented/tested in selected sites with a high potential for FLR providing both carbon and non-carbon benefits (e.g., Carooc Watershed Model Forest in Philippines) through participatory planning, community driven FLR investments and sustainable economic alternatives implemented at landscape level;
- monitoring capacity enhanced and both socio-economic and environmental benefits monitored with a minimum set of indicators well adapted to both national and regional contexts.

Components (2/2)

Efficient regional cross-sectoral platforms facilitate FLR implementation and scaling up to achieve the Paris Agreement and the Bonn Challenge

- knowledge shared and capacity built on FLR including on planning and implementing good practices, design of new business models, innovative results-based payments such as (REDD+,
PES);
- resources mobilized from impact funds and innovative partnerships (Marketplaces/CSR platforms...) and from climate/land degradation financing instruments (e.g. GCF, LCFN Fund, etc);
- more accurate and harmonized reporting on restoration goals and targets at all levels (NDCs, Aichi Target 15, Bonn Challenge and SDG 15).
### FLRM & Bonn Challenge & Paris Agreement
**IKI (4.8 M€/ US$ 5.3 M)**

<table>
<thead>
<tr>
<th>Region/Country</th>
<th>Political Partner</th>
<th>Implementation Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asia Pacific Islands</strong></td>
<td><strong>Asia Pacific Forestry Commission</strong></td>
<td>Regional Community Forestry Training Center for Asia and the Pacific (RECOFTC) Bajung Pangana Foundation</td>
</tr>
<tr>
<td>Philippines</td>
<td>Department of Environment and Natural Resources of the Philippines (DENR) - Forest Management Bureau (FMB); Carabao Waterhed Management Forest Reserve (Bohol Islands)</td>
<td>Regional Community Forestry Training Center for Asia and the Pacific (RECOFTC) Bajung Pangana Foundation</td>
</tr>
<tr>
<td>Fiji</td>
<td>Ministry of Agriculture and Forests (MAF); Ministry of National Planning, Office of Climate Change</td>
<td>Conservation International (CI)</td>
</tr>
<tr>
<td><strong>Africa</strong></td>
<td><strong>The African Union Commission Through the Food and Social Economic Policy for the Green Great Wall of the Sahara and the Sahel Initiative</strong></td>
<td>Forest, Policy, Strategy and Regulation Directorate, Ministry of Environment, Forest and Climate Change (MOEFC)</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>Ministry of Environment, and Forest (MEF)</td>
<td>Forest, Policy, Strategy and Regulation Directorate, Ministry of Environment, Forest and Climate Change (MOEFC)</td>
</tr>
<tr>
<td>Niger</td>
<td>Water and Forest Department of the Ministry of Environment, Urban Sanitation and Sustainable Development (DGUF-MSSUD); Permanent Intercontinental Committee for Drought Control in the Sahel (COMSA)</td>
<td>Niger National Agency for the Great Green Wall for the Sahara and the Sahel Initiative (ANLASI); Centre Regional Agroforestier (CRA)</td>
</tr>
<tr>
<td><strong>Mediterranean</strong></td>
<td><strong>The Committee on Mediterranean Forestry Questions- Silva Mediterranea</strong></td>
<td>The North-West Regional Director of the HECOPA (Girona provincial direction in charge of the Maxima Forests Association Monegros pour l'Entouragement de la Protection de la Nature (AMEPA))</td>
</tr>
<tr>
<td>Morocco</td>
<td>High Commission for Water, Forest and the Fight Against Desertification (HCDF); Ministry of Energy, Mines, Water, and Environment</td>
<td>The North-West Regional Director of the HECOPA (Girona provincial direction in charge of the Maxima Forests Association Monegros pour l'Entouragement de la Protection de la Nature (AMEPA))</td>
</tr>
<tr>
<td>Lebanon</td>
<td>Ministry of Agriculture - Directorate of Rural Development and Natural Resources (MNRN-MM)</td>
<td>Lebanese Forestry Initiative (LFI); Institut du Liban (ILIBAN)</td>
</tr>
</tbody>
</table>

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### Highlights

- Regionalization of a global commitment
- Regional Platforms as FLR multiplier (as it has been in South America)
- FLR multiple benefits at the center
**The Restoration Initiative (with UNEP and IUCN)**

**GEF (48 M€/ US$ 54 M)**

**Goal**
Contribute to the restoration and maintenance of critical landscapes that provide global environmental benefits and enhanced resilient economic development and livelihoods, in support of the Bonn Challenge

**Geography (11 national projects + 1 global project)**
- **Africa**: Cameroon, CAR, DRC, Guinea Bissau, Kenya (2), Tanzania, Sao Tome & Principe
- **Asia**: China, Myanmar, Pakistan

**Timeline**
- PPG: 2016-2017
- Implementation Phase: 2018-2022

---

**TRI Structure**

- 11 national child projects
- 1 Global Learning, Finance and Partnership child project
- 4 types of interventions
  - TRI Component 1: Policy Identification and Uptake
  - TRI Component 2: Implementation of Restoration and Complementary Initiatives
  - TRI Component 3: Institutions, Finance and Up-scaling
  - TRI Component 4: Knowledge, Partnerships, M&E
- 1 shared objective
  - “Contribute to the restoration and maintenance of critical landscapes to provide global environmental benefits and enhanced resilient economic development and livelihoods, in support of the Bonn Challenge”
The Restoration Initiative (with UNEP and IUCN)
GEF (48 M€/ US$ 54 M)

Highlights

✓ 10 countries and 3 GEF agencies involved, coordinating efforts

✓ South South exchange and capacity building

✓ Special effort on scaling up (through Finance, Policy and KM)

Expected results of TRI Chilgoza project in Pakistan
Expected results of TRI in South Kivu province (DRC)

Perspectives for FLR: New projects under the FLRM

- **New IKI-Germany Call**; Large scale Forest Landscape Restoration (FLR) in Africa - tree rich landscapes to foster biodiversity, climate change resilience and better livelihoods - 27 M euros FAO with GIZ, WWF-Germany, WRI, IUCN, WB, NEPAD

- **Green Climate Fund** in Madagascar and Malawi under development

- **GEF 7** - new impact program on Food Systems & Forest and Landscape Restoration – Very relevant for FLRM. An Asia Pacific strategy has been presented at the APFC meeting in October 2017 and bilateral discussions are happening.
Questions? Suggestions?

Thank You!고마워
3) China-GEF Partnership on Land Degradation in Dryland Ecosystems: Sustainable and Climate Resilient Land Management in Western PRC

Dr. Zengming Song

GEF Project Manager, CAF
Sustainable and Climate Resilient Land Management in Western PRC

Dr. Song Zengming
Central Project Management Office
2018-04-10

Outline

1. the first phase Partnership (2002-2013)
2. the second phase Partnership (2014-2023)
3. Climate Resilient Sustainable Land Management in Western PRC Project
Desertification in China

Decertified land area 2,611,593 km², 27.2%

Sandification in China

Sandified land area 1,721,175 km², 17.9%
Rocky Desertification

in Karst Areas of China

Rocky Desertified land area 120,020 Km²

PRC-GEF Partnership on Land Degradation in Dryland Ecosystems (the Partnership)

Director of SFA Mr. Jia Zhibang (right) meeting with the President/CEO of GEF Council Ms. Monique Barbut (left)

PSC Director Mme. Jiang Zehui (right) meeting with the President/CEO of GEF Council Ms. Monique Barbut (left)

Established in October 2002, the Partnership aims to combat LD in western China using IEM approaches

Established in October 2002, the Partnership aims to combat LD in western China using IEM approaches
Outline

1. the first phase Partnership (2002-2013)

2. the second phase Partnership (2014-2023)

3. Climate Resilient Sustainable Land Management in Western PRC Project

SLM comprehensive strategy in Western PRC 2014-2023

- Domestic and international situation is changing, it is necessary to innovate/develop the strategy on land degradation control
- Climate change, ecological sustainability, poverty alleviation/reduction land degradation in western PRC remains severe, resources and environmental restrictions, ecological civilization development strategy;

LD Control
IEM

SLM
INRM
Institutional arrangements

At the central level, continue to strengthen the coordination of the Project Steering Committee, CPCO and CPMMO, and include new member agencies (the Leading Group for Poverty Alleviation and Development Office of the State Council).

At the provincial level, strengthen the multi-level and cross-sectoral Provincial Leading Groups, PPCOs, and PPMOs.

At the international level, enhance the cooperation with ADB, WB, IFAD, GEF, and promote the participation of other international organizations, such as UNDP, UNEP, WWF, and TNC, etc.

Scope of the Partnership Development Strategy

Wind erosion/sandyfication area

Water Erosion

Erosion in Kaihui Area
Strategic priorities

Objective
To improve management of land and water resources, reduce poverty, increase incomes, protect biodiversity and combat climate change in Western PRC.

SP1
Upscale SLM technologies

SP2
Improve the ability to tackle climate change

SP3
Improve regional green development

SP4
Promote poverty reduction and gender equality

SP5
Strengthen institutional innovation in land management

Key innovative technologies and approaches in the strategy

1. Up-scaling of best practices;
2. Market-based mechanisms for up-scaling;
3. Innovative SLM climate-resilient technologies;
4. Improved monitoring and evaluation;
5. Global Environmental Benefits
6. Cost-effectiveness;
7. Green development;
8. Gender and vulnerable groups;
9. Women’s participation;
10. Alternative livelihood;
11. Strengthened ecological legislation;
12. Improved sustainable land management mechanisms.
Benefits of the Partnership Development Strategy

Local benefits

✓ Degraded land improved by SLM;
✓ Vegetation coverage increased;
✓ Land productivity increased;
✓ Water resource management improved;
✓ Average income raised compared with 2013; and
✓ with all the benefits of a prosperous society.

Global environmental benefits

✓ Improved provision of agro-ecosystem and forest ecosystem goods and services;
✓ Reduced greenhouse gas emissions from agriculture, deforestation and forest destruction, increased carbon sequestration; and
✓ Reduced vulnerability of agro-ecosystem and forest ecosystems to climate change and other human-induced impacts.
Outline

1. the first phase Partnership (2002-2013)

2. the second phase Partnership (2014-2023)

3. Climate Resilient Sustainable Land Management in Western PRC Project
Climate Resilient Sustainable Land Management in Western PRC Project

The objective of the project is to restore degraded land, enhance climate resilience, conserve biodiversity and improve livelihoods through sustainable land management.

Component 1: Improved the resilience of landscapes and ecosystems to climate change

Component 2: Strengthened management of degraded lands to support rural livelihoods and green development

Component 3: Enhanced SLM enabling environment and capacity for upscaling of SLM in Guizhou and Sichuan

Project overview

<table>
<thead>
<tr>
<th>Project Area</th>
<th>SLM sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inner Mongolia</td>
<td>3</td>
</tr>
<tr>
<td>Shaanxi</td>
<td>3</td>
</tr>
<tr>
<td>Gansu</td>
<td>4</td>
</tr>
<tr>
<td>Qinghai</td>
<td>3</td>
</tr>
<tr>
<td>Guizhou</td>
<td>1</td>
</tr>
<tr>
<td>Sichuan</td>
<td>2</td>
</tr>
<tr>
<td>Samsu</td>
<td>16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Thematic focus</th>
<th>Num</th>
<th>Project Area</th>
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</thead>
<tbody>
<tr>
<td>PPPs</td>
<td>2</td>
<td>Inner Mongolia, Shaanxi</td>
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<tr>
<td>PES</td>
<td>2</td>
<td>Gansu, Shaanxi</td>
</tr>
<tr>
<td>Carbon Sequestration</td>
<td>2</td>
<td>Qinghai (2)</td>
</tr>
<tr>
<td>Green Development</td>
<td>4</td>
<td>Sichuan (2), Shaanxi (1), Guizhou (1)</td>
</tr>
<tr>
<td>Forestland, farmland, grassland restoration</td>
<td>6</td>
<td>Inner Mongolia (2), Gansu (3), Qinghai (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E+, Cooperatives, Eco-tourism, Scientific</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poverty alleviation, etc.</td>
</tr>
</tbody>
</table>
Inner Mongolia activities snapshot

- Tree line cutting
- Water drilling demonstration
- Provisional farming activities

- Watering and fertilizing

- July control (watershed management) 2014

- Grassland restoration after sustainable grassland management

Main Activities in Gansu

- Double ridge farming
- Soil improvement
- Green Agroforestry system
- Blue agroforestry system
- Green Agroforestry system
- Blue Agroforestry system

- Jingyuan
  - Green Agroforestry system
  - Blue Agroforestry system
  - Green Agroforestry system
  - Blue Agroforestry system
Main Activities in Sichuan (design activities)

Green development activities

Tea tree planting under forest
Herb growing under forest
Breeding under forest
Grow Osmanthus under forest
Grow Camellia under forest
Grow Chrysanthemum veitchii and Tanacetum tussienense

Clean Energy
Breeding under forest
Grow Prunus salicina Lindl. trees

Junlian
Huaying

Main Activities in Sichuan (extended activities)

Bamboo tending for Huaying
Giant panda

Lacquer tree growing in Junlian
Achievements of the Project

**Achievements**
- Supported rural livelihoods and green development
-.UserId Sealed-up SLM technologies, strengthened landscape and ecosystem resilience to climate change
- Promoted innovation in project rational, mechanism, management and technology
- Implemented ecological civilization building, promoted low-carbon producing and living

Experience Sharing and International Cooperation

5th China-GEF Project Management Conference
July, 2016

Introduce the Partnership experience by Madam Hu Zhangcui
Experience Sharing and International Cooperation

Oct 26, 2016
UFRO Regional Congress for Asia and Oceania 2016

Introduce: Sustainable and Climate-Resilient Land Management in Western PRC - Achievements and Prospects of the GEF-PRC Partnership on Land Degradation

Experience Sharing and International Cooperation

June, 2017
Central Asian Countries Desertification Control Training Workshop
Experience Sharing and International Cooperation

June 13-17, 2017
WOCAT Symposium and the 18th
WOCAT Network Meeting
in Cali, Colombia

Experience Sharing and International Cooperation

Expert Workshop on Dryland Forest Restoration and Conservation in Central and Northeast Asia
August 13-18, Ulaanbaatar, Mongolia.

1) Provide a platform for sharing of knowledge and experiences on dryland forest ecology and forest restoration in respective countries, and
2) Identify specific areas of forest cooperation in the future.
Experience Sharing and International Cooperation
4) Lessons Learned from Successful Forest Greening in the Republic of Korea

Dr. Hyun Park
Director, NIFoS
Lessons learned from Successful Forest Greening in the Republic of Korea

2018. 4. 10.

Hyun Park
Division of Global Forestry
National Institute of Forest Science

Outline

1. A Question raised as an ODA Planner to transfer Korean successful story
2. Let’s see the details, what we found & realized ...
3. Then, What to do in the future?
I. A Question raised as an ODA Planner
   - to transfer Korean successful story

01. At a glance, what a miracle!

<table>
<thead>
<tr>
<th>After Korean War (1953)</th>
<th>Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNI per capita : US $67 (450 times)</td>
<td>GNI per capita : US $30,000</td>
</tr>
<tr>
<td>Population : 26 million (2 times)</td>
<td>Population : 52 million</td>
</tr>
<tr>
<td>Forest Stock : 6 m/ha (30 times)</td>
<td>Forest Stock : 180 m/ha</td>
</tr>
</tbody>
</table>

❖ How?
02. Trials of Forest Restoration

With laws and plans

Partial success, Slow progress

- 1945  Liberation from Japanese occupation
- 1946  Arbor day designation (April 5; early spring)
- 1950  Korean War broke out (~ 1953)
- 1951  Temporary Forest Protection Act
- 1952  3-year reforestation plan
- 1953  5-year erosion control plan
- 1954  2nd 10-year private forest reforestation plan
- 1958  10-year upstream soil conservation plan
- 1959  5-year fuelwood forest establishment plan

* Looks like impossible ~ ! *

03. Continuous failure

Kept a plateau in Forest Stock

- Considerable devastation to the Forests in Korea until early 1950s
- During Japanese occupation (1910-1945), Korean War (1950-1953)
- Due to poor condition (1953-1970s): for fuelwood, for cropland
- Remained stagnant until 1972, despite of considerable efforts to rehabilitate
04. Rapid changes by strong leadership?

| Under the military government |

Special interest (philosophy) of top leader?

- **Keen interest in Economy & Forest**
  - Enactment of Forest Law: Dec. 27, 1961
  - Erosion Control Act: Jan. 15, 1962
  - Establishment of Korea Forest Service in 1967
    (enlarge the organization: bureau → agency)

- **Eradication of 5 major socialills**
  - 1. Smuggling
  - 2. Narcotics
  - 3. Illegal timber harvesting
  - 4. Gangster
  - 5. Quasi-reporter

- Military Coup by General Park (May 15, 1961)

- Incidence of large-scale illegal logging

- Put 600 people into jail due to illegal logging in 1964

05. Factors of Successful Forest Restoration

| Multiple Factors, but by the excellent leader |

Significant Changes in Policy - Leadership

- Reorganization of Forestry administration (1967, 1973)
- Establish Korea Forest Service (KFS) from bureau level to Administration
- Empowerment for cooperative participation with ‘Saemaul Movement’
- Establish Korea Forest Service (KFS) from bureau level to Administration
- **Strategic Plan & Practical Implementation to ensure the outcome**

- **Strong Leadership, Systematic approach**
06. For the practical perspectives, are you satisfied?

**Excellent Leader? Lucky situation! We are envy you!!**

- Strong Leadership – good philosophy, spiritual campaign
- Strong Administration - law enforcement, control
- Without an Excellent Leader, is it impossible ??

**As a Forester, Forest policy makers ...**

- What was the role of Forest policy maker (FPM) ?
- To implement the successful story,
  
  What do I have to do now, as a forester in developing country?
- What was the role of FPM in forest greening in Korea?

II. Let’s see the details, what we found & realized ...
01. New perspectives for the success factors of FR

What’s the momentum of the changes in 1973?

- As an outcome of 1st 10-year forest greening plan (1973-1978)
  - Right at the point (initiation time) of the greening project? Magic?
  - Growing stock is calculated targeting only for trees thicker than 6cm in DBH
  - Planted small trees, so at least 5 years prior to get statistics... then, before 1967?

Even before the establishment of Korea Forest Service!

![Graph showing growing stock per capita and per ha](image)

Inflection point in 1973

02. Readiness – Fundamentals for FR policy

Systematic Approach with Scientific Basis

- Forestry society provided scientific and technological tools for the policy making during 1960s.
- The 5 key technologies for successful forest greening (during 1960s)
  1. Forest survey & inventory: understanding the situation
  2. Tree improvement: for long-term investment, selection of suitable trees
  3. Seeds & Nurseries: high-quality seedlings
  4. Tree planting & tending: not for a tree, but for making forests
  5. Forest pest control: endless tending, nurturing (until now)
- Some technologies contributed greatly to forest restoration coupled with cooperation with the private sector (extension, use of developed technique)
  - From fundamentals prior to the practical policy!
03. Extension for implementation & Cooperation

| Practical use of developed techniques |

- Nitrogen fixing bacteria
  - For leguminous species used as fertilizer trees
  - *Rhizobium spp.*, 10 tons/yr in 1967 and 1968 ✗ before the 1st greening plan
- Natural Enemy Production (from 1970s)
  - To control forest pests such as pine caterpillar, fall webworm
  - *Beauveria bassiana*, 18,000–40,000 units per year by 1983

![Root nodules made by Rhizobium sp.](image1)
![Caterpillar occupied by B. bassiana](image2)

04. Strategic approach for FLR* (1)

**PLAN (P)**

*Forest Landscape Restoration*

*Establishment of Plan at the National Level (1973 ~ 1987)*

- Announcement of the 1st and 2nd 10-year Forest Rehabilitation Plans
- A Copy of the 10-year Forest Rehabilitation Plan

- Landscape: A large area defined by common productive characteristics or administrative management (ex. Production region, supply-shed, eco-region, biome, state, municipality) ✗ human resources (governance)
05. Strategic approach for FLR (2)

DO (D)

Seed and Seedling Production (for righteous planting)
: proper tree species in each site (pioneer species & fertilizer trees such as legumes) ※ income source for the local people

06. Strategic approach for FLR (3)

CHECK (C)

Maintenance and Enforcement ※ human resource management
: with 3rd step inspection system for checking survival rate of planted trees

Cross-Inspector from County (city), Province & Federal government
Survival rate (90% in average) was linked into the evaluation of government officials
※ Limit of replanting (impossible to use false trick)
⇒ Sincere efforts (irrigation, fertilizer) & Implementation of science, technology
07. Strategic approach for FLR (4)

ACT (A) : Not just planting, but with good care

*Erosion Control, Fuel-wood Plantation, Reforestation(tendering)*
under good inventory (national survey) & scientific technology

08. Strategic approach for FLR (5)

ACT (A)

*Participation, Governance*

*Spiritual campaign: Patriotism*

“If you love your country, plant trees”

Park, Chung-hee

Late President of the Republic of Korea
09. Summary - Way to get Successful Greening

Strategic approach & Strong leadership

Plan – Do – Check – Act (PDCA) strategy

- Whole scale approach: Establishment of plan at national level
- Based on fundamentals: Forest soil & Forest resources Survey
  ※ under the support of UNDP, FAO, GTZ (GIZ; Germany)
- 1st (1973~1978) and 2nd (1979~1987) 10-year Forest Rehabilitation plans
- Scientific approach: With considering future - righteous planting
  - With production of Seed and Seedling: Seed orchard, Nursery clusters
  - Black locust, Alder, Pitch pine, Poplar ... for greening (vs. future use)
- Management approach: Maintenance and enforcement - inspection system
  - Consensus from people: Erosion control for cropland, fuelwood plantation
  - With empowerment for the planting activity: appeal to patriotism

10. (Tips) Additional, but Critical tools for success

Practical implementation

- Not just for forestry, but for operational tools
  - Reorganization of Forestry administration (1967, 1973)
  - Establish Korea Forest Service (KFS) from bureau level to Administration
  - Move from Min. of Agriculture to Min. of Home Affairs (local government)
  - Empowerment for cooperative participation with ‘Saemaul Movement’
- Practical Implementation to ensure the outcome
  - Not just for planting, but for the survival rate
  - Three-step inspection system to monitor survival rate of planted trees

Social change –Industrialization, Economic growth

- Successful result of ‘Resettlement policy’ to prohibit the ‘slash & burn farming’
- Changes in fuel from wood to charcoal & petroleum fuel

- Strong Leadership, Systematic approach, Social Condition
III. Then, What to do in the future?

01. Instruction

| Readiness: Science & Technology is the Basis of FLR |

- The technologies covering the greening processes preceded forestry policies.
- The 5 key findings of R&D for successful forest greening in Korea were
  (i) Forest survey & inventory, (ii) Tree improvement, (iii) Seeds & Nurseries,
  (iv) Tree planting & tending, and (v) Forest pest control.
- Some technologies contributed greatly to forest restoration coupled with cooperation with the private sector.
- Forest greening projects should be developed with a systematized policy with landscape approach with considering PDCA process.
- In developing countries, forestry experts are struggling to create appropriate conditions of forest rehabilitation due to technical and economic limits. In that case, the obstacles could be overcome by Official Developing Assistance (ODA) from international communities.

 tatto ODA for FLR need to be focused on readiness (start from S & T)!
02. Cooperative activity with publics

| Not only by foresters, but by publics! |

**Awareness of the role of forest & forestry**

- Fact: Forest Rehabilitation took a key role for rural development in Korea
- In a rocky country, FM is the base for preventing flood (for stable farming)
- Ultimately, FM was one of the key components for economic development

However, the public says:
- Yes, Planting tree is good!
- No forester is needed, anymore!
- But, Planting forest is not good, because it is almost useless.
- Trees are growing naturally, it is easy to make our land green.

Needs to enlarge awareness of the role of forest & forestry
- Forest still provides us lots of benefit such as ecosystem services
- Forest needs continuous tendering as nurturing kids

- Forestry as the 1st and 2nd industry is not attractive to public in Korea

03. Forest Ecosystem Services

![Forest Ecosystem Services Diagram]

<table>
<thead>
<tr>
<th>Service</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Storage Enhancement</td>
<td>20 billion USD (19%)</td>
</tr>
<tr>
<td>Air Quality Improvement</td>
<td>21 billion USD (20%)</td>
</tr>
<tr>
<td>Wildlife Protection</td>
<td>2 billion USD (2%)</td>
</tr>
<tr>
<td>Forest Therapy</td>
<td>2 billion USD (2%)</td>
</tr>
<tr>
<td>Erosion Control</td>
<td>13 billion USD (13%)</td>
</tr>
<tr>
<td>Forest Recreation</td>
<td>13 billion USD (13%)</td>
</tr>
<tr>
<td>Biodiversity Conservation</td>
<td>5 billion USD (5%)</td>
</tr>
<tr>
<td>Water Quality Improvement</td>
<td>6 billion USD (6%)</td>
</tr>
<tr>
<td>Total</td>
<td>103 billion USD</td>
</tr>
</tbody>
</table>

US$ 2,060/year/person

23/25
04. Sustainable Development Goals (SDGs)

| For the Global Societies |

Forest for Peace & Happiness

- Sustainable Forest management in the past
  - Focused on the Yield of timber
- Normalized forest (developed in 18th century from Germany)
- Harvesting timber as the same amount as the growth of stand
- Sustainable Development in Forestry
  - Good forest is the starting point for further progress
  - Comprehensive and long-term plan is a prerequisite of proper use
  - Need to focus on people rather than just on forest & forest products
- To keep/expand the function of forest as the ecosystem service provider
- Various SDGs targets: 1(livelihood), 2(food), 5(equity), 6(water), 8(job), 13(climate change), 15(terrestrial ecosystem), 17(global partnership)
- Holistic approach to keep ‘homeostasis’ of global society

- It is time to think about forestry from inclusive approach!

Workshop on FLR & Resilience to Climate Change in NE Asia

SAVE OUR FORESTS

Thank you for your attention!
5) Situation of Agriculture and Government Policy for Agricultural Development in ROK

Prof. Jeong Bin Im
Professor, Seoul National University
Situation of Agriculture and Government Policy for Agricultural Development in the Republic of Korea (ROK)

April. 10. 2018

Jeongbin Im
Professor, Department of Agricultural Economics
Seoul National University

Contents of Presentation

I. Introduction
II. Agricultural Situation in the ROK
III. Agricultural Policy Changes by Time Periods
IV. Agricultural Development Strategies
I. Introduction

- The ROK was a typical underdeveloped country by 1970s
- Successful export-oriented industrialization transformed it into a modern industrialized country
  - With rapid growth of over 7% per annum over 40 years
  - GDP: US$ 8 billion (1970) to US$ 1,340 billion (2015), 11th in the world
  - Per Capita GNI: US$ 254 (1970) to US$ 27,440 (2015), 46th in the world

- Objectives of presentation
- How has the ROK’s agriculture and policy been changed in the process of rapid economic development and trade liberalization?
- What are the recent policy goals in the ROK’s agricultural sector?
II. Agricultural Situation in the ROK

(1) Farmland Structure of Korea

- Total land: 10 million ha (99,538 km²)
- Cultivated land: 1.7 million ha, 17% of total land area
  - Paddy Field: 0.93 million ha, 56% of total cultivated land
  - Upland: 0.76 million ha, 44% of total cultivated land
- About 64% of Total Land is mountainous and hilly area

(2) Status of Agriculture in the ROK's Economy

- Agricultural share in national GDP is decreasing:
  27.4% (1970) → 7.9% (1990) → 2.0% (2015)
- The share of agriculture in total employment is also declined:
  50.4% (1970) → 17.9% (1990) → 5.2% (2015)
- The radical decreases of agricultural share in national economy have been occurred within one generation in the ROK.

  It is a result of the rapid industrialization and urbanization.

- However, agriculture still plays important roles in not only the land use and employment, but also social and economic stability and livelihood in rural area of the ROK.
Economic Development & Agriculture

- The ROK has made a rapid economic growth since 1960s
  - Annual average growth rate of GDP is 6.7% during 1970-2010, which is mainly led by non-agricultural sector
  - Manufacturing sector grew sharply, annual growth rate is 10.5%
  - Agricultural sector showed a relatively low growth rate of 1.7%

<Table 1> Annual Growth Rate by Sector (CAGR, %)

<table>
<thead>
<tr>
<th>Period</th>
<th>GDP</th>
<th>Ag-Forestry&amp;Fisheries</th>
<th>Mine &amp; Manufacturing</th>
<th>Electricity, Gas &amp; Water</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970-1979</td>
<td>8.4</td>
<td>3.6</td>
<td>15.5</td>
<td>12</td>
<td>9.7</td>
</tr>
<tr>
<td>1980-1999</td>
<td>8.6</td>
<td>4.0</td>
<td>10.2</td>
<td>9.6</td>
<td>9.9</td>
</tr>
<tr>
<td>1990-1999</td>
<td>7.2</td>
<td>2.0</td>
<td>9.5</td>
<td>10.2</td>
<td>8.6</td>
</tr>
<tr>
<td>2000-2010</td>
<td>3.8</td>
<td>1.0</td>
<td>8.3</td>
<td>7.5</td>
<td>4.7</td>
</tr>
<tr>
<td>1970-2010</td>
<td>6.7</td>
<td>1.7</td>
<td>10.5</td>
<td>13.2</td>
<td>6.4</td>
</tr>
</tbody>
</table>

(3) Production Share by Commodity

- Agricultural Production has been steadily increasing from KRW 6 trillion (1980) to 45 trillion (2015)
  - The share of Livestock, Fruits and Vegetable in the value of agricultural production has been increasing

- However the share of rice production in total agricultural production has been decreasing since 1990

<Table 2> Production Value and Share by Farming Type

<table>
<thead>
<tr>
<th></th>
<th>Unit: KRW trillion won, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Agriculture Production</td>
<td>6.34(100)</td>
</tr>
<tr>
<td>Rice</td>
<td>2.18(34.4%)</td>
</tr>
<tr>
<td>Livestock</td>
<td>1.27(20.0%)</td>
</tr>
<tr>
<td>Fruit</td>
<td>0.25 (3.9%)</td>
</tr>
<tr>
<td>Vegetable</td>
<td>1.44(20.6%)</td>
</tr>
<tr>
<td>Others</td>
<td>1.20 (18.9%)</td>
</tr>
</tbody>
</table>
(4) Farmland Size

- Total planted land is decreasing in the process of urbanization
  : 2.3 million ha(1970) → 1.7 million ha(2015) (26% decrease)

- Number of farm-household is decreasing much faster than planted land
  (56% decrease)

- Therefore, average farmland size per farm is increasing
  : 0.93 ha(1970) → 1.54 ha(2015)

- But farmland size in the ROK are still very small compared to other countries
  : Arable Land size per farm
    Japan-1.7ha, Netherlands-22ha, U.S.A.-120ha

(5) Rice Dominant Farming System

- Rice farming takes dominant position in ag. production and farm economy in the ROK

- Rice(2015) accounts for
  1) 16% of total agricultural production
  2) 54% of total agricultural land
  3) 58% of total farm household
  4) 19% of total farm revenue

- The reasons are as follows:
  1) Staple food, government have maintained price and income support
  2) Rice farming is relatively easy and time saving due to mechanization
  3) Rice was exempted from market opening through WTO and FTA.
(6) Agricultural Trade

- Agricultural import is increasing rapidly
  : 0.5 billion US $ (1970) → 34.8 billion US $ (2015)

- Agricultural export is also increasing

- Agricultural trade deficit has increased greatly

<Table 3> Situation of Agricultural Trade

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Import</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nation wide</td>
<td>1.8</td>
<td>21.6</td>
<td>59.6</td>
<td>160.4</td>
<td>436.5</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.5</td>
<td>3.1</td>
<td>5.4</td>
<td>6.8</td>
<td>34.8</td>
</tr>
<tr>
<td>Export</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nation wide</td>
<td>0.9</td>
<td>17.2</td>
<td>85.4</td>
<td>172.3</td>
<td>526.8</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.3</td>
<td>8.0</td>
</tr>
</tbody>
</table>

(7) Food Self-sufficiency Rate

- Self-Sufficiency rate for all grains (including feed grains) has continuously dropped since the 1980s
  : 48.4% (1985) → 23.8% (2015)

- Self-sufficiency rate for wheat and corn became less than 1%
  : However rice is almost self-sufficient level

<Table 4> Self-sufficiency Rate of Major Grain

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>103.3</td>
<td>108.3</td>
<td>91.4</td>
<td>102.9</td>
<td>102.0</td>
<td>104.6</td>
<td>101.1</td>
</tr>
<tr>
<td>Barley</td>
<td>63.7</td>
<td>97.4</td>
<td>67.0</td>
<td>46.9</td>
<td>60.0</td>
<td>24.3</td>
<td>21.9</td>
</tr>
<tr>
<td>Wheat</td>
<td>0.4</td>
<td>0.1</td>
<td>0.3</td>
<td>0.1</td>
<td>0.2</td>
<td>0.9</td>
<td>0.7</td>
</tr>
<tr>
<td>Corn</td>
<td>4.1</td>
<td>1.9</td>
<td>1.1</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Soybeans</td>
<td>22.5</td>
<td>20.1</td>
<td>9.9</td>
<td>6.8</td>
<td>9.7</td>
<td>10.1</td>
<td>9.4</td>
</tr>
<tr>
<td>Total for all grains</td>
<td>48.4</td>
<td>43.1</td>
<td>29.1</td>
<td>29.7</td>
<td>29.4</td>
<td>27.6</td>
<td>23.8</td>
</tr>
</tbody>
</table>
III. Agricultural Policy Changes: Historical Perspective

(1) Agricultural Policy: 1950s and 1960s

- The ROK’s agricultural policy has undergone a number of significant changes since 1950s and 1960s.

- Policy Issues:
  Main goals of the agricultural policy were to resolve food shortage and to terminate the problems of tenant farmers and landowners.

- Policy Direction:
  (1) Creation of owner farming through “Land Reform”
  - Farmland reform was implemented from 1950 until 1957 to create independent family farming
  (2) Establishment of agricultural administration system
  - Rural Development Administration (1962) and ag. cooperative organization (1961) were founded and ‘the Basic Agricultural Law (1967)’ was enacted to conduct the systematic ag. policy.
(2) Agricultural Policy : 1970s

- Policy Issues:
  Main goals of the agricultural policy were to increase food production and to modernize the production system.

- Policy Direction:
  (1) Increase of productivity through “Green Revolution”
    : Expansion of agricultural R & D investment, development of high-yield variety, improvement of irrigation system, agricultural mechanization were pursued.

  (2) Price support policy for rice and barley began in 1970.
    : As a result, self-sufficiency of rice was achieved in 1977

  (3) New town movement called ‘Saemaul Undong’ launched in 1970.
    : Government provided financial and materials supports to farmers and villages for improving the rural living conditions.

(3) Agricultural Policy : 1980s

- Policy Issues:
  Main goals of the agricultural policy were to increase farm households income to reduce the enlarged income gap between urban and farm households due to the fast growth in non-agricultural sector.

- Policy Direction:
  (1) Promotion of cash-crop production such as livestock, fruit, and vegetables
    : Price stabilization policy for livestock, fruit, and vegetables began

  (2) Creation of off-farm income sources through making the rural industrial complexes
    : Rural Income Source Development Law(1983) was enacted Financial incentives for rural company such as favorable loan and tax exemption

  As a result, production of livestock, fruit, and vegetables began to increase and industrial complexes began to appear in rural area.
(4) Agricultural Policy : 1990s

- Policy Issues:
  Main goals of the agricultural policy were to promote the structural reform and to enhance competitiveness in the era of trade liberalization according to the implementation of WTO AoA and FTA.

- Policy Direction:
  (1) Reforming agricultural structure to enhance competitiveness
    - First investment plan amounting 42 trillion won (1991)
    - Second investment plan amounting 15 trillion won (1994)
    - Third investment plan amounting 45 trillion won (1998) to reform the agricultural structure and improve the living conditions in rural areas from 1992 to 2004
    - Fourth investment plan amounting 119 trillion won was made in 2003, which is a 10-year plan from 2004 to 2013.

(4) Agricultural Policy : 1990s (continued)

- Policy Direction:
  (2) Creation of large scale commercial farming
    - The farm size ownership limit was increased from 3 ha to 10 ha (1993) and was abolished (2002) to create large scale commercial farming
    - A new farmland banking system was introduced in 2005 to minimize the fragmentation of farmland and encourage young full-time farmers to increase the scale of their farms more easily

  (3) Stabilization and support of farm income
    - Several DP programs have been introduced for supporting farm income
    - Direct payment for early retirement of aged farmers (1997)
    - Direct payment for environmentally friendly farming (1999)
    - Direct payment for less favorable areas (2004)
(4) Agricultural Policy : 1990s (continued)

- Policy Direction:

(4) Promotion of environmentally friendly farming to maintain sustainable agricultural production and to preserve environment
- ‘Environment-friendly Agricultural Promotion Act’ was legislated in 1997

(5) Strengthening of rural development policy to enhance the quality of life in rural areas
- ‘The Special Law for the Improvement of Quality of Life in Rural Areas’ enacted in 2005
- Investment plan for RD amounting 20 trillion won, which is a comprehensive plan for RD during 2005-2010

(5) Agricultural Policy : since 2000

- Policy Issue:
Main goals of the agricultural policy to find the new engines of growth for the continuous development in agricultural sector

- Policy Direction:
New government established in 2012 is pursuing a more offensive approach in agricultural policy

(1) Promotion of value added agro-food processing industry
- Focus of Ag. policy shifted from mainly raw production to not only primary production but also secondary food processing industry and thirdly green tourism.

(2) Building up a consumer-oriented agricultural system and
- Strengthening a food safety management system
- Customer of Ag. policy changed from mainly farmer to not only farmer, but also consumer and food processing enterprises.

(3) Expansion of agro-food exports
Recent Agricultural Policy Focus: 6th industrialization of agriculture

- Recently the Korean government is pursuing the integration of traditional agriculture with food processing, leisure and tourism industry.
  - It is for creating the high value-added agriculture and enhancing the farmer’s income.

(Figure 1) Expansion to value-added agribusiness from traditional agriculture

IV. Agricultural Development Strategies

1. Basic Structure of Agricultural Policy

   “Four Areas for Government Policy”

1) Policy for Farmer, which is to make economically self-survival farmers

2) Policy for Agriculture, which is to make productive and sustainable agriculture with enhancing the competitiveness of agricultural sector

3) Policy for Rural Community, which is to create vitality of rural society and to improve the living conditions in rural area

4) Policy for Agricultural Related Industry, which is to effectively set up the vertical integration from input industry (Seed, Fertilizer, Pesticide, Machinery and Equipment) to value added food-processing industry
2. Objectives of Agricultural Policy

“Five Objectives of Agricultural policy”

1) Goal for Farmers, which is to provide opportunity for high income

2) Goal for agricultural industry, which is to create higher value chains

3) Goal for Consumers, which is to provide freshness, quality and safe food

4) Goal for Rural Residents, which is to enhance the quality of life

5) Goal for Future Generations, which is to transfer clean environment and beautiful landscape in rural area

Thank you for listening!

jeongbin@snu.ac.kr
6) Erosion Control Works and Rehabilitation Examples of Landslide Damage in ROK

Dr. Sang Ho Lee
Director, Korean Association of Soil and Water Conservation
Erosion Control Works and Rehabilitation Examples of Landslide Damage in ROK

Dr. Sang Ho LEE

Korean Association of Soil and Water Conservation

Climate and Landslide in ROK

- Annual precipitation in Korea: 1,200~1,500mm
- Rainy season (Jun~Sep): 50~60% of annual precipitation
- The average precipitation of rainy season in 2016: 845.1mm (about 50% of annual average precipitation 1,272.5mm)

Landslide occurrence
- (Landslide & Debris flow Hazard) the recent decade (08~17): 240ha on average, 54ha in '16, 94ha in '17
- (Victims) the recent decade (08~17): 6 casualties on average, zero in '14~'16
**Successful reforestation by erosion control works**

Degraded forest

After erosion control works

Successful reforestation

---

**Classification of Erosion Control Works**

Erosion control work in mountainous districts: A landslide prevention work, A landslide restoration work, A mountainous district conservation work, A mountainous district restoration work
Classification of Erosion Control Works

Erosion control work in coastal areas: A work to create a forest for damage prevention along the beach, A work to prevent coastal erosion.

A work to create a forest for damage prevention along the beach
A work to prevent coastal erosion

Classification of Erosion Control Works

Erosion Control Work in wild stream: A mountain stream conservation work, A mountain stream restoration work, A construction work of an erosion control dam

A mountain stream conservation work
A construction work of an erosion control dam
Effects of Erosion Control Works

- Conservation of national land, prevention of disasters, water resources conservation, environmental preservation, etc.

* Erosion control dam 2,550 m³/site, a mountain stream conservation 1,770 m³/km

Erosion Control Dam

- Concrete Dam
- Boulder Dam
- Concrete Block Dam
- Steel Dam
Eco-friendly Erosion Control Works

A mountain stream conservation work (Gyeongnam)

A mountain stream conservation work (Jeonbuk)
History of Erosion Control Works

- In 1907
  - "terrace sodding works" and "terrace planting works" were adopted to the area near of the Changui-mun, Seoul

- Since 1918
  - erosion control works in Geum, Nakdong, and Seomjin rivers for securing water resources
  - forest areas was partially recovered from 1922 to 1947

- In 1952
  - Village Forest Association in the county level were organized
  - wheat flour, which was donated by the UN Korean Reconstruction Agency, was provided as a labor charge for the rehabilitation works in the eroded area
The First Erosion Control Works in ROK
Changui-mun

History of Erosion Control Works

- torrent erosion control works has been executed in 1955 through the assistance of the International Cooperation Agency
- In 1962, Erosion Control Law was enacted
- the first 10-year Forest Development Plan (1973-1978): 82,268 ha hillside erosion control works, and 500 km of torrent erosion control works.
- the second 10-year Forest Development Plan (1979-1988): 78,268 ha hillside erosion control works, 3,300 km of torrent erosion control works.
- the Forest Resources Enhancement Plan (1988-1997): 4,710 ha hillside erosion control works, 2,410 km of torrent erosion control works, and 1,300 of erosion control dams
- the fourth 10-year Forest Development Plan since 1998-2007
- The fifth 10-year Forest Development Plan since 2008-2017
Landslide in Mt. Woomyeon in Seoul (2011)

Photo source: OhmyNews

Photo source: YONHAPNEWS

Photo source: YONHAPNEWS

Photo source: FUTURE ECO

Video source: KBS
Landslide in Mt. Woomyeon

Mt. Woomyeon (293m)

<table>
<thead>
<tr>
<th>Date</th>
<th>Area</th>
<th>Sites</th>
<th>Damaged area (ha)</th>
<th>Victims</th>
<th>Rehabilitation Cost (million USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jul 27, 2011</td>
<td>Total</td>
<td>81</td>
<td>109.7</td>
<td>Deaths 16, Injury 51, Evacuee 413</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Woomyeon</td>
<td>12</td>
<td>69</td>
<td>Deaths 16, Injury 50, Evacuee 413</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>69</td>
<td>40.7</td>
<td>Injury 1</td>
<td>16.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Precipitation</th>
<th>A site</th>
<th>B site</th>
<th>C site</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 hour</td>
<td>85.5 mm</td>
<td>112.5 mm</td>
<td>85.5 mm</td>
</tr>
<tr>
<td>cumulative (24hrs)</td>
<td>230 mm (15hrs)</td>
<td>424.5 mm (24hrs)</td>
<td>384.5 mm (24hrs)</td>
</tr>
</tbody>
</table>

Information source: Seoul Metropolitan Government

BEFORE

AFTER

Photo source: Seoul Metropolitan Government
Thank you!

Acknowledgement

The Korea Forest Service and Seoul Metropolitan Government provided photos and information on erosion control works, ROK.
7) Prediction of Forest Fire Danger Rating (FFDR) in DPRK

Dr. Myoung Soo Won
Senior Researcher, NIFoS
Prediction of forest fire danger rating (FFDR) in DPRK: Modeling of MODIS fire product, 5km-resolution meteorological data, daily weather index (DWI), fuel model index (FMI) and topography model index (TMI)

Myoungsoo Won, Ph.D.
Div. Of Forest Ecology and Climate Change, National Institute of Forest Science

Korea Forest Fire Danger Rating System (KFFDRS)
**KFFDRS**

- **Korean Forest Fire Danger Rating System**
  - This system has been operating at the NIFoS since 2003.
  - Forest danger rating index has provided an hour everyday to people, central and local government.

**KFFDRS Database**

- **Korean Forest Fire Danger Rating System Database**
  - National Fire Database (from NIFoS and KFS)
  - Weather Database (KMA)
  - Mountain Weather Database (NIFoS)
  - Hotspot Database (NIFoS)
  - National Topography Database (NGII)
  - National Forest Database (NIFoS and KFS)
KoMIS

- **Korean Mountain Meteorology Information System**
  - KoMIS supply mountain weather data such as a temperature, humidity, wind and precipitation per minute from NIFoS.
  - In current, 200 automatic mountain meteorology stations (AMOS) were installed at the mountain area.
  - AMOS will be installed more than 620 stations by 2021

---

R&D Flow chart: Forest fire occurrence probability model

- **Weather**
  - Humidity (Rh, Eh)
  - Temperature
  - Wind Speed

- **Fuel Type**
  - Conifer
  - Mixed
  - Non-conifer

- **Topography**
  - Ignition point
  - Direction

- **Logistic Regression Model**
- **Forest Fire Occurrence Data (the past 5 years)**
- **Spatial Analysis**
  - Forest Fire Site (N sites)
  - Frequency Analysis

**Daily Weather Index (DWI)**

**Fuel Model Index (FMI)**

**Topography Model Index (TMI)**

**Forest Fire Danger Rating Index (FFDRI)**
Key results

1. Extraction of fire spots using MODIS data.
   - Building Database of fire ignition points for the inaccessible area.

Materials and Methods: info. collection of fire spots

**MODIS Sensor**
- Pixel resolution: 250, 500, and 1000 m
- Overpass times: 10:30
- Spectral bands: 36 (0.4 – 14.5 um)
Materials and Methods: Image data processing flowchart

Processing flowchart of MOD14

MOD03 (Geolocation Field) → Latitude, longitude info.

MOD14_L2 (Fire mask, QC) → Fire mask, QC

Georeferencing → Fire mask, extraction of location info.

Confidence normal → QC Check

Y: Forest info., Fire mask → N: Primary

Temporal cluster of fire mask → Fire mask in 5x5 pixels

No fire ignition → Temporal redundancy check

Continued fire → Fire mask in 5x5 pixels

Y: Fire mask < day, s → N: Wind info., Forest fire ignition map

*QC check - at optimum confidence

Materials and Methods: MODIS14 Layer Table (Product, QC)

MODIS14 Fire Mask Product

QA Flag (32-bit)

- Selection of materials
  - Nominal confidence
  - High confidence
- QA Flag
  - Optimum confidence
  - Less than optimum confidence
Key results: example of MODIS14 fire mask

April 29, 2012

Key results: Forest fire(FF) spots DB for the inaccessible area

Total 3,037 fire spot points
- Period: 2011~2015 (5yrs)
Key results: Hypothesis for problem solving

1. Consider fire spotting at the time of the first detection when a forest fire was detected continuously at a particular pixel as a fire ignition point and occurrence time.
2. When a fire spot is detected at different times in the same pixel, it is regarded as an individual forest fire. However, apply only when the ignition time differs by more than 5 days.
3. Identify whether forest fires have spread by 4 days after the ignition time, centered on ignition points.
   - Remove fire spotting after setting 3 x 3 pixel area after ignition.
   - After 2 days, check 5x5 pixel area.
   - Identification of data after cloud data.
4. Removal of fire spotting in the same forest area using wind UV vector and wind direction.

Key results: Reanalysis of fire spots by hypothesis

[Before reanalysis]
- (Syn) A total of 3,637 fire spot points.

[Reanalysis]
- (Syn) Extracting a total of 1,469 fire spot points.

Example: Large fire of Erlang-gun, Hamkyung-bukdo (2015. 04. 26.)

[Consideration]
- FF detection (April 26) → Fire spread (April 27)
  - Wsmax = 5.0 ~ 30.0 m/s
  - WD: NW
  - Ignition point estimation considering detection time and WS/WD.
Key results: Reanalysis of fire spots by hypothesis

[Before reanalysis]

• (5yrs) A total of 3,637 fire spot points

    2011 (1,111 points)  2012 (275 points)  2013 (283 points)  2014 (1,206 points)  2015 (762 points)

[Reanalysis]

• (5yrs) Extracting a total of 1,469 fire spot points

    2011 (368 points)  Remove 67%  2012 (151 points)  Remove 45%  2013 (172 points)  Remove 39%  2014 (554 points)  Remove 54%  2015 (224 points)  Remove 71%

Key results: Reanalysis of fire spots by hypothesis

[Before reanalysis]

• (5yrs) A total of 3,637 fire spot points

[Reanalysis]

• (5yrs) Extracting a total of 1,469 fire spot points

Removes about 50% of duplicate fire spot points.
Key results: Monthly FF frequency for reanalysis data

<table>
<thead>
<tr>
<th>Year</th>
<th>Fires</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>358</td>
<td>25.1</td>
</tr>
<tr>
<td>2012</td>
<td>151</td>
<td>10.4</td>
</tr>
<tr>
<td>2013</td>
<td>112</td>
<td>11.7</td>
</tr>
<tr>
<td>2014</td>
<td>554</td>
<td>42.0</td>
</tr>
<tr>
<td>2015</td>
<td>224</td>
<td>15.2</td>
</tr>
<tr>
<td>Total</td>
<td>1,409</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>M/Y</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0.4%</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0.4%</td>
</tr>
<tr>
<td>3</td>
<td>14%</td>
<td>5</td>
<td>0.6%</td>
<td>0.5%</td>
<td>1.2%</td>
</tr>
<tr>
<td>4</td>
<td>12.3%</td>
<td>2.6%</td>
<td>12.9%</td>
<td>12.8%</td>
<td>5.3%</td>
</tr>
<tr>
<td>5</td>
<td>46</td>
<td>62.7%</td>
<td>6.7%</td>
<td>44.9%</td>
<td>3.5%</td>
</tr>
<tr>
<td>6</td>
<td>27.7%</td>
<td>57</td>
<td>57</td>
<td>13.1%</td>
<td>5.6%</td>
</tr>
<tr>
<td>7</td>
<td>0.6%</td>
<td>0</td>
<td>0.5%</td>
<td>0</td>
<td>0.6%</td>
</tr>
<tr>
<td>8</td>
<td>0.6%</td>
<td>0</td>
<td>0.6%</td>
<td>0</td>
<td>0.6%</td>
</tr>
<tr>
<td>9</td>
<td>0.6%</td>
<td>0</td>
<td>0.6%</td>
<td>0</td>
<td>0.6%</td>
</tr>
<tr>
<td>10</td>
<td>4.1%</td>
<td>7</td>
<td>4.1%</td>
<td>0</td>
<td>0.4%</td>
</tr>
<tr>
<td>11</td>
<td>17.7%</td>
<td>1</td>
<td>0.7%</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>0.2%</td>
<td>0.2%</td>
<td>0.2%</td>
<td>0.2%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Key results:

2. Establishment of weather database in forest fire area.
Materials and Methods: 5km digital weather data of KMA

- Analysis data: 5km DW data of KMA
  - Period: 2011~2015 (5yrs)
- Mesh info. of KMA DW data
  - Grid interval: 5km
  - Grid #: EW149 × SN 253 → 37,697
  - Total grid distance: EW 745km; SN 1,288km
  - Standard grid point: (43, 136) / (38.0N, 128.0E)

Materials and Methods: Extraction of weather data of fire spot points

- MODIS, MOD14
  - Extraction of fire spots from the MODIS images

- Design of 5km grid points for spatial analysis
  - Digital weather (ASCII) → Raster
  → building

5km DW grid points

[Climate mapping on the Korean Peninsula(5km grid)]
- Weather factors: Temp., RH, WS/WD, Precipitation
Key results: Weather database (5km grid) of fire spot points

Temperature  Relative humidity  Wind speed

Key results: Weather database (5km grid) of fire spot points

- 21 -

- 22 -
Key results: Development of daily weather index model

- Logistic Regression
- Weather variables: temp (mean, max, min), relative humidity (mean, min), effective humidity, wind speed (mean, max), precipitation

\[ p = \frac{\exp(\beta_0 + \beta_1 X_1 + \ldots + \beta_j X_j)}{1 + \exp(\beta_0 + \beta_1 X_1 + \ldots + \beta_j X_j)} \]

### Estimated Correlation Matrix

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Intercept</th>
<th>T1D_max</th>
<th>RH1D_min</th>
<th>EH1D_avg</th>
<th>WS1D_avg</th>
<th>T1D_avg</th>
<th>RH1D_min</th>
<th>RH1D_avg</th>
<th>WS1D_max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.0000**</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>T1D_max</td>
<td>-0.1104**</td>
<td>1.0000</td>
<td>0.2491</td>
<td>-0.4296</td>
<td>-0.0536</td>
<td>-0.0536</td>
<td>0.2036</td>
<td>-0.2282</td>
<td>0.1224</td>
</tr>
<tr>
<td>RH1D_min</td>
<td>0.3213**</td>
<td>-0.1107</td>
<td>1.0000</td>
<td>-0.1107</td>
<td>-0.4296</td>
<td>0.2036</td>
<td>-0.2282</td>
<td>0.1224</td>
<td>-0.0536</td>
</tr>
<tr>
<td>EH1D_avg</td>
<td>0.4399**</td>
<td>0.0318</td>
<td>-0.1107</td>
<td>1.0000</td>
<td>-0.0890</td>
<td>0.1177</td>
<td>-0.3546</td>
<td>-0.3699</td>
<td>0.0017</td>
</tr>
<tr>
<td>WS1D_avg</td>
<td>-0.0152**</td>
<td>-0.0084</td>
<td>0.0374</td>
<td>-0.1107</td>
<td>1.0000</td>
<td>-0.0890</td>
<td>0.1177</td>
<td>-0.3546</td>
<td>0.0017</td>
</tr>
<tr>
<td>T1D_avg</td>
<td>-0.0536**</td>
<td>-0.0084</td>
<td>0.0374</td>
<td>-0.1107</td>
<td>1.0000</td>
<td>-0.0890</td>
<td>0.1177</td>
<td>-0.3546</td>
<td>0.0017</td>
</tr>
<tr>
<td>RH1D_min</td>
<td>0.2099**</td>
<td>-0.0932</td>
<td>-0.1490</td>
<td>-0.0932</td>
<td>1.0000</td>
<td>-0.0890</td>
<td>0.1177</td>
<td>-0.3546</td>
<td>0.0017</td>
</tr>
<tr>
<td>RH1D_avg</td>
<td>-0.2282**</td>
<td>-0.0932</td>
<td>-0.1490</td>
<td>-0.0932</td>
<td>1.0000</td>
<td>-0.0890</td>
<td>0.1177</td>
<td>-0.3546</td>
<td>0.0017</td>
</tr>
<tr>
<td>WS1D_max</td>
<td>0.1234**</td>
<td>0.0026</td>
<td>0.0017</td>
<td>-0.0738</td>
<td>-0.0499</td>
<td>0.0738</td>
<td>-0.0469</td>
<td>1.0000</td>
<td></td>
</tr>
</tbody>
</table>

- p < 0.01

### Result of the logistic regression analysis

- Sample Number: 10,283 (fire spot points of the fire day, 3 days before and after the non fire days)

<table>
<thead>
<tr>
<th>Response Profile</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire</td>
<td>8,314</td>
</tr>
<tr>
<td>1</td>
<td>1,969</td>
</tr>
</tbody>
</table>

Probability modeled is Fire = 1

-2 Log Likelihood: 8,350.329

\[ \chi^2 = 1,207.665 \]

- p < 0.01

### DWI model of DPRK

\[ [1 + \exp(-2.7425 - 0.0905 + T_{max} - 0.0517 + RH_{min} + 0.0334 + E_H + (0.1234 + \text{WS} \text{avg}))^{-1}]^{-1} \]
Key results: The probability interval of DWI model in DPRK

<table>
<thead>
<tr>
<th>Interval ratio</th>
<th>DWI</th>
<th>Estimated probability interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>1</td>
<td>[0.00000 – 1.1138]</td>
</tr>
<tr>
<td>20%</td>
<td>2</td>
<td>[1.1138 – 1.6559]</td>
</tr>
<tr>
<td>30%</td>
<td>3</td>
<td>[1.6559 – 2.0132]</td>
</tr>
<tr>
<td>40%</td>
<td>4</td>
<td>[2.0132 – 2.5141]</td>
</tr>
<tr>
<td>50%</td>
<td>5</td>
<td>[2.5141 – 2.9238]</td>
</tr>
<tr>
<td>60%</td>
<td>6</td>
<td>[2.9238 – 3.3452]</td>
</tr>
<tr>
<td>70%</td>
<td>7</td>
<td>[3.3452 – 3.7828]</td>
</tr>
<tr>
<td>80%</td>
<td>8</td>
<td>[3.7828 – 4.3065]</td>
</tr>
<tr>
<td>90%</td>
<td>9</td>
<td>[4.3065 – 4.9471]</td>
</tr>
<tr>
<td>100%</td>
<td>10</td>
<td>[4.9471 – 1.0000]</td>
</tr>
</tbody>
</table>

Key results: Verification of the DWI model in DPRK

The frequency of fire day and non-fire day by DWI model

<table>
<thead>
<tr>
<th>DWI</th>
<th>Observed Fire</th>
<th>Expected Fire</th>
<th>Observed Non-Fire</th>
<th>Expected Non-Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>36.51</td>
<td>988</td>
<td>991.48</td>
</tr>
<tr>
<td>2</td>
<td>80</td>
<td>68.88</td>
<td>948</td>
<td>959.12</td>
</tr>
<tr>
<td>3</td>
<td>92</td>
<td>90.42</td>
<td>956</td>
<td>937.58</td>
</tr>
<tr>
<td>4</td>
<td>118</td>
<td>110.54</td>
<td>910</td>
<td>917.46</td>
</tr>
<tr>
<td>5</td>
<td>109</td>
<td>130.57</td>
<td>919</td>
<td>897.43</td>
</tr>
<tr>
<td>6</td>
<td>145</td>
<td>150.24</td>
<td>963</td>
<td>877.76</td>
</tr>
<tr>
<td>7</td>
<td>164</td>
<td>171.45</td>
<td>885</td>
<td>857.55</td>
</tr>
<tr>
<td>8</td>
<td>218</td>
<td>195.23</td>
<td>810</td>
<td>832.77</td>
</tr>
<tr>
<td>9</td>
<td>234</td>
<td>224.84</td>
<td>794</td>
<td>803.15</td>
</tr>
<tr>
<td>10</td>
<td>279</td>
<td>203.20</td>
<td>751</td>
<td>736.80</td>
</tr>
</tbody>
</table>
Key results

3 Establishment of forest map database in DPRK

- Development of Fuel Model Index (FM) model

Key results: Forest type map in DPRK

- Data: 68 SPOT images (10m resolution)
  - Satellite images from 2004 to 2008
  - Classification: ISODATA

- Results:
  - Forest area: Approximately 8.98 million ha, 75.45% of DPRK's land area
  - Stocked forest: 6.15 mil. ha / Unstocked forest: 2.83 mil. ha
  - Stocked forest: Deciduous forest 314.11ha (5.1%), Evergreen forest 182.46ha (20.8%), Mixed forest 186.01ha (34.4%)

(Data source: National Institute of Forest Science, NIFoS, 2008)
Key results: Fuel Model Index (FMI)

Forest type characteristics of forest fire area in DPRK
- Deciduous forest 59.4%, Evergreen forest 21.7%, Mixed forest 18.9%
- (ROK) Evergreen 98.0%, Mixed 1.7%, Deciduous 1.4%

<table>
<thead>
<tr>
<th>Index</th>
<th>Danger rating</th>
<th>Fuel Model Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>↑</td>
<td>Mixed</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Evergreen</td>
</tr>
<tr>
<td>5</td>
<td>Moderate</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>↓</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>High</td>
<td>Deciduous</td>
</tr>
</tbody>
</table>

Key results

Establishment of topographic information in DPRK
- Development of Topography Model Index (TMI) model
Materials and Methods: Topographic info. in DPRK

- Analysis data: 1° DEM(30m grid)
  - Extraction info. elevation and aspect distribution map

Key results: Topography Model Index (TMI)

- Results:
  - (Freq. analysis) extraction of altitude info. of fire spot points in forest area
  - 1,459 fire spot points
  - It is divided into 5 classes using the average of the altitude and the standard deviation.

<table>
<thead>
<tr>
<th>Interval</th>
<th>Elevation</th>
<th>Fire freq</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x &lt; 128$</td>
<td>Less than 550m</td>
<td>828</td>
<td>56%</td>
</tr>
<tr>
<td>$128 \leq x &lt; 128$</td>
<td>550-1,044m</td>
<td>542</td>
<td>37%</td>
</tr>
<tr>
<td>$128 \leq x &lt; 328$</td>
<td>1,044-1,537m</td>
<td>83</td>
<td>6%</td>
</tr>
<tr>
<td>$328 \leq x &lt; 528$</td>
<td>1,537-2,030m</td>
<td>14</td>
<td>1%</td>
</tr>
<tr>
<td>$x \geq 528$</td>
<td>More than 2,030m</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1,459</td>
<td>100%</td>
</tr>
</tbody>
</table>
Key results: Topography Model Index (TMI)

- Results
  - (Frea. analysis) extraction of aspect info. of fire spot points in forest area
  - 1,409 fire spot points
  - Eight aspect analysis of fire spot points

<table>
<thead>
<tr>
<th>Index</th>
<th>Danger rating</th>
<th>Aspect</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>Low</td>
<td>NE/E/S</td>
<td>≥1.537m</td>
</tr>
<tr>
<td>1.0</td>
<td></td>
<td>W</td>
<td>1.044-1.537m</td>
</tr>
<tr>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td></td>
<td>SW/N</td>
<td>≤1.044m</td>
</tr>
<tr>
<td>3.5</td>
<td></td>
<td>NW</td>
<td>≤1.044m</td>
</tr>
<tr>
<td>4.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>High</td>
<td>SE</td>
<td>≤1.044m</td>
</tr>
</tbody>
</table>

Key results

- Verification of the statistical model by case study
- Development of forest fire danger rating system (FFDRS) in DPRK
Real-time weather info. sharing system

Analysis flow chart for processing FFDRI
Automation of FFDRI Process Model

- [Image of maps and data processing]

Automation of FFDRI Process Model

- [Image of maps and data processing]
Simulation of actual FF case of statistical model (Case Study)

[ April 15, 2017 ]

15hr Temp./RH/EH/WS

Daily Weather index(DWD) 03hr/12hr/15hr/13hr

(FFDI) 09hr/12hr/15hr/13hr
Simulation of actual FF case of statistical model (Case Study)

April 15, 2014 (51 forest fires)

April 25, 2014 (70 forest fires)

April 27, 2014 (1 forest fire)

Development of FFDRS in DPRK
Thank you for attention!
8) 중국과 조선의 산지생태계와
생태복원 및 향후 협력

Prof. Yonghuan Jin
Associate Professor, Institute of Applied Ecology, CAS
중국과 조선의 산지생태계와 생태복원 및 향후 협력

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발표순서

1. 중국과 조선의 산지와 산지생태계

2. 중, 조 양국의 산림자원

3. 중, 조 양국의 산지생태계복원의 노력

4. 결론 및 향후의 협력방향
1. 중국과 조선의 산지와 산지생태계

1.1 산지 특성과 산지생태계의 중요성

산지: 고도가 높고 경사도가 심하며 올라와 있는 3D 지형체
사이: 많은 산이 분포하는 지역, 산맥과 구분
속성: 평원, 고원, 분지(구릉 포함)와 구별됨

1. 중국과 조선의 산지와 산지생태계

1.1 산지 특성과 산지생태계의 중요성

- 산지의 수적 어절성
  급격한 환경 변화과정과 고도의 어절적인 생태환경 보유
- 산지환경의 허약성
  사면 환경의 약한 지형력, 쉽게 파괴됨
  산의 오르막과 내리막, 저지는 모두 외부에 대한 지형력이 약함
- 생태적 지위의 불포화성
  산지 생태환경의 다양성으로 인한 생물 생장 제한성, 일부는 불가능

산지-- 생물 다양성이 높고, 특유 생물종 분포
지구상의 생물 다양성 연구의 점소 및 보호 중점지역 분포
1. 중국과 조선의 산지와 산지생태계

1.2 중국의 산지 특성

- 면적비율: 2/3차지 (산지, 구릉, 고원포함)
  - 산지33%, 고원26%,
  - 구릉10%, 분지29%,
  - 평원10%

- 분포방향:
  - 동서방향
  - 남북방향
  - 북동-서남방향
  - 기타방향

- 생물종다양성:
  - 흰자식물3만여종
  - 채추동물6300여종
  - 고유생물종 풍부
1. 중국과 조선의 산지와 산지생태계

1.3 조선반도의 산지특성

조선반도의 산지면적비율: 2/3이상
조선반도의 산지(산출기)
- 남북방향: 백두산맥, 남립산맥, 태백산맥, 경산산맥,
  북수산맥, 연화산맥, 주월산맥
- 북동-남서방향: 광주산맥, 차령산맥, 소백산맥
  노령산맥,
- 북동쪽-서남서방향: 강남산맥, 적유령산맥, 부전령산맥,
  연전산맥, 면아산맥
- 북북동-남남서방향: 북대봉산맥, 아호비령산맥,
  마식령산맥,
(김우식, 2006)

1. 중국과 조선의 산지와 산지생태계

1.3 조선반도의 산지특성

- 해발 300m이미만 평야와 구릉 면적 120,899km², 비율 53%
- 산지 (Mt. region)(기준: 300-2500m)
  (경사와 고도자료에 근거)
  - 면적은 95,416km², 비율은 42%
  - NK 51%, SK 31%
- 산지의 분포:
  - 북동쪽 63%, 남서쪽 16%
  (탁과 김, 2013)
1. 중국과 조선의 산지와 산림생태계

1.3 조선반도의 산지 특성

- 반도의 지형분류
  - 산지: 49%
  - 구릉: 32%
  - 평야: 19%

- 지형의 변화특성
  높은 산지는 북쪽과 동쪽에서 서쪽과 남쪽으로 가면서 낮아지는 경향

(박과 김, 2017)

1. 중국과 조선의 산지와 산림생태계

1.3 조선반도의 산지 특성

북측지역

1) 개마고원, 동부산악지대의 대부분 차지, 해발고도 1000m 이상 준평원을 형성.
2) 동북지역, 해발고도 1500m 이상 산지의 90%가 분포.
3) 높은 산줄기는 남북으로 연결
   → 동경자는 주로 서부지역에 분포
   → 동부지역 경사 급하, 수력발전에 유리
4) 평균해발고도 400m 이상지역은 52%
1. 중국과 조선의 산지와 산림생태계

1.4 산지의 생태적 복원의 중요성과 필요성

- 생태계 구조의 파괴나 훼손
  생산자-식물과 임금수량 감소,
  소비자-야생동물 수량 감소.
  분해자-미생물 종류와 수량의 감소 및 기능부족,
  환경의 변화(온, 수분, 영양분, 공기, 토양 등).

- 생태계기능의 약화, 열아
  먹이사슬 역화, 물질순환과정 왜곡, 안정성 저하

산사태나 홍수 등 자연재해 증가, 생산량 감소

1. 중국과 조선의 산지와 산림생태계

1.4 산지의 생태적 복원의 중요성과 필요성

훼손된 산지생태계의 생태복원

- 생태기능의 회복과 제고
- 생물다양성 증가
- 산지의 경제적수의 제고
- 산지주민의 안정된 생활공간

산지주민의 농원조성
지속가능한 발전유지
대략한 생활환경개선
2. 중, 조 양국의 산림자원

2.1 중국의 산림자원의 변화과정

![산림면적(만ha) 피복율(%)](chart)

조사시기


2.2 중국의 산림자원과 산림생태계기능

### 중국의 산림자원
- 산림면적 : 2.08억ha
- 산림축적 : 151.37억m³
- 산림피복율 : 21.63%
- 단위면적 축적 : 89.79m³
- 산림생장량 : 4.23m³/ha/년

### 중국의 산림생태계기능
- 산림식생의 탄소축적량 : 84.27억t
- 산림생태계 수자원함량 : 5807.09억m³/년
- 산림생태계 토사고정량 : 81.91억t/년
- 산림생태계 오염물질 흡수량 : 0.38억t/년
- 산림생태계의 먼지제거기능 : 58.45억t/년
2. 중, 조 양국의 산림자원

2.3 중국의 산림자원과 황막화토지 분포

산림자원 분포도 (국가산림조사실계원, 2013)
황막사토지분포도 (李育材, 2014)
(261.16만km², 국토면적비율 27.2%)
(국가임가국, 2015)

2. 중, 조 양국의 산림자원

2.4 조선 산림 면적의 변화과정과 현황

● 1970년대 조선의 산림 면적 985만ha
● 1997년 산림 면적 755만ha (FAO)
● 2000년, 산림 면적 821만ha (FAO)
● 1998년, 산림 면적 753만ha (조선의 농업회사화 및 환경보호에 관한 원칙회의, 1998)
● 2006년 5월 국토환경성의 UNCCD 제출보고서
  1990년 산림 면적은 820만ha,
  2000-2005년, 893만ha
2. 중, 조 양국의 산림자원

2.4 조선의 산림면적의 변화과정

1990년대 대비 2010년 산림감소비율 (FAO, 2010)

3. 중, 조 양국의 산지생태계복원의 노력

3.1 중국의 노력

중국정부에서 추진하는 6대 중점 생태공정

- 천연림자원보호공정
- 뇌경환림환경교정
- "3복"복용림 및 청양유역 등 중점방향공정체계 추진사업
- 목결전진 황사발생원 방지공정
- 야생동식물보호 및 자연보호구 건설공정
- 중점지역 속성용제림단지 조성사업
3. 중, 조 양국의 산지생태계복원의 노력

3.1 중국의 노력

중국의 천연림보호프로그램

 단기목표(2000) 천연림내 임목병체감소와 생태공익림사업추진등
중기목표(2010) 생태공익림사업추진과 천연림경영목표의 변화추진 등
장기목표(2050) 천연림자원의 회복과 주로 인공림을 통한 임목공급 등

목적:
천연림자원보호와 회복을 중심으로
(1) 천연림의 생태기능 제고 (2) 산간지역경제 발전 추진

추진과정에서
천연림의 목재생산 → 산림자원 보육
보호와 동시에 임내 자원의 합리적인 이용
산림경영과 관리체계의 개혁

3. 중, 조 양국의 산지생태계복원의 노력

중국의 천연림보호프로그램

추진범위
서남, 서북, 동북지역 및
해남성, 하남성
포함한 18개 성

IAE
3. 중, 조 양국의 산지생태계복원의 노력

중국의 퇴경화림환경호看不出

- 1999년, 사천성, 삼차성, 감숙성 3개 성에서 시범 추진
- 2003년, 국무원 "퇴경화림조례" 실시, 사업의 전면 추진
  사업의 범위 : 25개 성과 신강건설면, 1987개 현
- 2010년까지 퇴경화림 조림 1467만 ha, 황산향무지 조림 1733만 ha
- 퇴경화림 후의 도급경영 기한 : 산림회복 후 70년까지 연장이 가능
- 2012년, 계속 실시하기로 결정(지역에 따라 실시방안이 다름)
- 2014-2016년, 사업 실시한 면적 3010만 ha(200만 ha정도)
- 2017년의 사업 임무, 1230만 ha(82만 ha)를 대상으로 실시
- 2017년 결정, 2기 퇴경화림의 총 면적 8000만 ha(520만 ha)로 확대

3. 중, 조 양국의 산지생태계복원의 노력

중국의 퇴경화림환경호看不出
3. 중, 조 양국의 산지생태계복원의 노력

3.2 조선의 노력

산림 조성계획의 수립과 행정

☑ 산림 조성 10년 계획 (2001~2010) 수립
☑ 김정은 국방위원장은 당, 국가경제기관, 근로단체
책임자들과의담화에서 10년 안에 넓게소득 산을 모두 수립하리라
하겠다는 의지를 전명 (12.5.9)
☑ 도지관리와 보호사업, 간석지 개간, 도지관리사업, 산림조성과
보호관리사업을 통한 수립화 원리화, 물관리사업, 도로의
현대화 증량화 고속화, 수산자원 보호사업, 환경보호 및 자연보호
관리사업 등을 강조
☑ 2023년까지 656억가구 조립계획 수립

3. 중, 조 양국의 산지생태계복원의 노력

3.2 조선의 노력

산림 조성계획의 수립과 행정

- 김정일 국방위원장의 특별지시, 전국의
  수립화, 원리화
- 김정은 국방위원장, 나무심기행동 참가
  ☑ 김정은 국방위원장, 기념식수를 위해
    헌하 구덩이를 파 놓은 것을 보고
    나무심기를 제대로 하기 위해서는
    구덩이 파는 것부터 해야 한다고
    하며 직접 구덩이를 파고 나무를 삼었다.
3. 중, 조 양국의 산지생태계복원의 노력

3.2 조선의 노력

김정은, 4. 27, 2012. "로동신문"
김 정 은
사회주의강성국가건설의 요구에 맞게 국토관리
사업에서 혁명적전환을 가자물데 대하여
일, 국가경제기관, 군단단장, 책임임명군단장과 함 꼭
주방 (2012년 4월 27일)

그런데 이립 산림조성과 보호관리사업이 계대로 진행되지 못하고있습니다. 세부적 중, 가동중의 내용
함께, 산림조성과 나무의 보호관리는 필수적으로 개선되어 왔으며, 지금 우리 나무에는 절박함이가
산림조성의 문제들이 많습니다. 적립물을 나무가 되어 [사회의 민], [정리의 민], [소년단합], [아동 및
학생가족과] 나무가 많이 잘나가 재가 숲이 크게 없었습니다. 나무들이 많이 싹트고 산림을 보호하기 위한 전담적,
정부적인 대책을 세워야 합니다.

산림조성과 보호관리사업을 계획적으로 실시하여 10 년으로 빌가승인이를 모두 수립해야야 하겠습니다. 이것은 우리 나라의 환경을 알아야하며 이입니다.

3. 중, 조 양국의 산지생태계복원의 노력

3.2 조선의 노력

김정은위원장의 도착

1) 10년안으로 벌거숭이산들을 수립화-당의 확고한 결심이며 의지

2) 산림조성사업은 장기성을 가는 사업이만큼 전망성있게 계획적으로
조직전행하여야 한다

3) 산림조성사업은 산림의 형실화와 지배적특성, 현실적조건을 과학적으로
타단한데 기초하여 논자별계획과 전망계획을 명백히 세우고 여감없이

4) 산림조성사업은 경제건설과 인민생활향상에 솔것있는 나무들로 목재류,
기름나무들, 삼과실림, 망나무들, 풀프 및 종이원료등을 조성하는
방법으로 하여야 한다.
3. 중, 조 양국의 산지생태계복원의 노력

3.2 조선의 노력

김정은위원장의 로작

5) 중앙과 지방들에서 양모장들은 잘 꾸리고 나무모생산을 과학화, 공업화, 집약화하여야 한다
6) 스트로브스소나무와 장성이밀나무 등 속성수 묘목을 많이 생산
7) 적지적수의 원칙에서 나무심기를 하고, 바늘잎나무와 넓은잎나무를 배액하여 심어야 한다
8) 나무심기를 절적으로 하고 싶은 나무에 대한 비생애를 잘하여 나무의 자율성을 결정적으로 제고해야 한다
9) 선림조성과 함께 선림보호관리사업에 큰 힘을 넣어야 한다
10) 인민들의 땅감문제를 결정적으로 해결하여야 한다

3. 중, 조 양국의 산지생태계복원의 노력

3.3 중, 조 양국의 협력과 실천

나선지역으로 낙엽송묘목지원
묘목 운전을위한 준비작업
(2003.4.20)(1차)

나산지 산지에 식재된낙엽층 묘목
(2004.4.)
3. 중, 조 양국의 산지생태계복원의 노력

3.3 중, 조 양국의 협력과 실천

2차로 나선시 지역에 지원, 운송된 낙엽성묘목(2004.4)  
나선시 지역에서 낙엽성묘목을 식재하는 과정(2004.4)

나엽성묘목의 원산지(중국 연변)  
라선시에서 일군을 동원하여 모목을 식재(2004.4)

3. 중, 조 양국의 산지생태계복원의 노력

3.3 중, 조 양국의 협력과 실천

중국과학원 심양생태연구소에서 지원한 4배체아카시아 림(2004년 지원)

4배체아카시아(2006.9)

4배체아카시아(2005.9)

중-조 과학원 전선림(2014.6)
3. 중, 조 양국의 산지생태계복원의 노력

3.3 중, 조 양국의 협력과 실천

중국과학원 산양생태연구소에서 지원한 자동기상관측장비

조선국가과학원 식물생태연구소 상원시험장에 설치된 자동기상관측장비

meteorological instruments

(2009년에 지원)

3. 중, 조 양국의 산지생태계복원의 노력

3.3 중, 조 양국의 협력과 실천

국제학술회의와 상호방문 등 다양한 형식을 통한 교류

회의주제: International Symposium on Ecological Conservation and Sustainable Development of Forest Resources in Northeast Asia

주최: 중국과학원
심양생태연구소

장소: 중국연길
날짜: 2005.8. 24-27
3. 中, 조 양국의 산지생태계복원의 노력

국제학술회의와 상호방문 등 다양한 형식을 통한 교류

회의주제:
동북아시아 훈손된 산지생태계 복원과 지속가능한 산림경영

주최: 중완과학원
세양응용생태연구소, IUFRO
날짜: 2007.11.18-21
장소: 중완 산양

3. 中, 조 양국의 산지생태계복원의 노력

공동주제 학술세미나

제손된 산지생태계의 생태적 복원에 관한 중-조 공동세미나 개최

Sino-DPR Korea Joint Seminar on Ecological Restoration of Degraded Mountain Ecosystem
November 5-10, 2012, Shenyang

주최: 중완과학원세양응용생태연구소
날짜: 2012.11.12-11.27
장소: 중완 산양
3. 중, 조 양국의 산지생태계복원의 노력

공동세미나 협의

- 산지생태계의 복잡성과 생물다양성
- 산지 산림생태계의 건강과 지속가능한경영
- 조림과 산지생태계 복원
- 산지 허손임지의 복구와 생물다양성보호
- 양묘정구축과 허손된 산지의 생태적 복구

3. 중, 조 양국의 산지생태계복원의 노력

3.3 중, 조 양국의 협력과 실천

조선의 학자들을 심양(IAE)으로 조정, 교류

심양등용생태연구소에서 조정한 조선과학원식물학연구소의 연구자(2006, 5)

조선과학원대표단, 중국과학원의 조정으로 심양방문(2011, 11)
3. 중, 조 양국의 산지생태계복원의 노력

3.3 중, 조 양국의 협력과 실천

중국과학원대표단, 조선국가과학원의 초청으로 평양방문(2010.7)

중국과학원대표단, 조선국가과학원의 초청으로 평양방문(2014.6)

3. 중, 조 양국의 산지생태계복원의 노력

조선 국토성, 임업분야 연구단 중국으로 파견

2011.11. 국토성 종자, 양료, 양묘경 등 분야 "조선의 조림과 농업연구단", 중국 심양 방문, 및 7일간의 관광분야 연구
3. 중, 조 양국의 산지생태계복원의 노력

심양동용생태연구소(IAE)에서 Northeast Asia Eco-Forum 개최

조선의 관련분야 학자들을 초청, 중국의 국내외학자들과 학술교류

생태포럼 주제

- The 1st forum: Ecosystem health and regional sustainable development (2009, Shenyang),
- The 2nd forum: Low carbon society (2010, Shenyang)
- The 3rd forum: Sustainable development and regional ecological security (2011, Shenyang)

제2회 동북아생태포럼(2010),
조선과학원 대표단 4명 참석, 3명 발표

제3회 동북아생태포럼(2011),
조선과학원 대표단 6명 참석, 4명 발표
4. 결론 및 향후의 협력방향

1. 지금까지 추천한 다양한 협력과정을 소중히 하여 기고 앞으로도 지속적인 협력, 교류가 중요

2. 향후 양국, 다국간의 국제적인 다양한 협력과 교류의 확대 필요

3. 협력을 통해 상호간의 경험을 교류, 성과의 공유를 추진

4. 혁신된 산지생태계 생태복원사업을 조성사업의 중요성
   - 시범지를 조성하고 장기적인 생태환경 모니터링을 구축
   - 장기적인 모니터링 결과로 통해 연구성과 도출
   - 생태복원 사업지성과의 보급

금수강산은 황금보배산
황금보배산도 수요하지만 금수강산이 더욱 중요하고 필요합니다

绿水青山就是金山银山
就是要金山银山，也要青山绿水
감사합니다
9) Forest Restoration Campaign in DPR Korea

Mr. Kwang Nam Hwang

Senior Officer of Science and Technology Department, General Bureau of Forestry, MoLEP
1. Understanding of forest restoration campaign

1) Importance

- Covered forest in about 80% of whole territory

- Precious resource and properties to be handed over to next generation

- Key role in development of economy and livelihood

- Contribution to climate change mitigation and supply clan ecoenvironment
2) Policy of the Government

- General mobilization in tree planting work including on 2nd March, Tree Planting Day
- General mobilization movement for land administration in spring and autumn period
- Forest Master Plan for 30 years (2013-2024) and long-term, stepwise and annual planning
- DPRK Law on Forest adapted
- Commands from central to county for forest restoration campaign

3) Concept of forest restoration campaign

To transform all the mountains into “treasure mountains”, into “gold mountains” within ten years as the President Kim Il Sung and the Chairman Kim Jong Il had intended
2. Forest status before starting the restoration campaign

Due to overcutting non-wood land was increased into 20% from 1990s to 2010 compared with one in 1970s

- Lowering water storage function
- Increasing soil loss

Comparing to 1970s, loss of water source was increased by 7 times when having 1000mm of annual mean precipitation, and severe soil loss is also apparent.

Deforestation

Consistent natural disaster from early 1990s

Overcutting (reduction of timber forest area)

Food production and firewood collection

Fire, Pests, etc
2) Impact

- Inflicted to economic development and livelihood improvement including coal and paper production firewood supply and others.
- Washed away soil and sand from forest land to low land including rivers and streams, reservoir, railway and road, community and arable land in rainy season, and damage from flood and landslide.
- Embedded arable land due to flood and landslide to reduce the farming area.
- Dried up river and inflicted to economic construction and livelihood improvement through electric production, irrigation.

3. Forest Restoration Campaign

1) Necessary

- To make all the mountains into green.
- To protect forest from different damage.

To restore degraded sloping land in a short period.

- To prevent climate change and response to risk of natural disaster.
2) Objectives

- To transform all mountains in the country into “treasure mountains”, into “gold mountains”

Forest restoration campaign is a war to ameliorate nature.
All the people mobilize in forest restoration campaign.

3) Long term plan and stepwise plan

**Long-term plan: (2015~2024)**
To improve forest in a sustainable way by restoring degraded forest immediately and transforming into “treasure” and “gold” ones.

**Stepwise plan:**
To prepare material base for economic and people’s livelihood development by conducting afforestation to make all the mountains into green and conservation work of already planted forests.
Stepwise tasks

1st step task (2015~2017)
To strengthen seedling production capacity and finish tree planting in bared mountains of important area

2nd step task (2018~2024)
To make all the mountains into green by maintaining survival rate of planted trees into over 90% and preventing forest fire and pest while reducing level of timber consumption.

Further vision

- Improvement of eco-environment through making all the mountains into green
- Contribution to economic and livelihood development by improving water storage capacity and preventing soil loss
Issues to be addressed

- Development of approach of tree species selection with principle of right tree in right land
- Technical extension and training for afforestation and forest conservation
- Improvement of material and technical base for forest restoration and management

All mountains into "treasure" and "gold" ones
Thank You!
10) Introducing Status and Prospect of Agroforestry Management in DPRK

Mr. Song Hwan Ryom
Senior Officer of Afforestation Department, General Bureau of Forestry, MoLEP
Introducing status and prospect of agroforestry management in DPRK

Jungsan County, South Phyongan Province
Suin County, North Hwanghae Province
Yonthan County, North Hwanghae Province

Needs of introducing agroforestry

- Decrease of agricultural yield by abnormal climate change
- Limited arable land
- The least area in worldwide: 280 phyong
  180 phyong in DPRK

- Decrease of production of medicinal and edible herbs
- Destruction of forest ecosystem by fire and interference

20 ~ 40° steep area:
400 thousands of hectares of patches in mountainside,
50 = 500 m²/ha, yr
5 = 5 mm/hr, yr

Since 1990s
Actively introducing as economic strategy since 2013

**Governmental measures**

- **DPRK Law on Forest** revised and enlarged, April 2013
- **Rules of Agroforestry Management** adopted, May 2013
- Organization of Non-permanent central agroforestry management committee, March 2013
- Begin of lectures on agroforestry management in agricultural universities in nationwide since 2013
- Organization of special research unit in academy of forestry and also academy of agriculture in 2014
- Organization of Korean agroforestry management technical association under the general union of Korean sci-tech

**Methods of agroforestry**

- tree + crops (corn, bean, sweet potato...)
- tree + herb (medicinal & edible herb, fodder...)
- tree + tree (shrubs, fruit...)

**Improvement of ecological environment,**
Solving food, raw material for industry & foodstuffs
Introducing status of agroforestry management

Agroforestry sites: about 200 thousand

Suan County North Hwanghae Province
Yonthan County North Hwanghae Province
Sunchon City South Phyongan Province

Create model units
Generalization in nationwide

Introducing status of agroforestry management

95% Surviving rates
1.3 times amount of growth

In model sites of agroforestry management

Planting trees in 200 thousands of hectares of patches in mountainside,
Creating 50 thousands of pastures in forestland in Sepho tableland
Cooperation and exchanges

FAO

SDC

Other international organizations

Management of agroforestry, integrative watershed, natural disaster risk
Mitigation of climate change, sustainable management of lands and forests

Experiences and lessons

Capacity building of technicians and experts

Strengthening of scientific research

Providing seeds and saplings

Conservation of lands and soil

Establishing of monitoring and assessment system for development of agroforestry
Prospect of introducing agroforestry management

Realizing planning of economic affairs

- Soil conservation
- Development of sci-tech
- Planting trees
- Producing saplings
- Management calculation
- Allocation of incomes

Diversification of agroforestry management structure

- High trees
- shrubs
- herbs
- mushrooms
- moss
Prospect of introducing agroforestry management

- Providing protection of eco-environment and sustainability
- Development and use of organic manure, bio-pest/herbicides and microbe corresponding with the forest ecosystem
- Elevation of recycle speed of nutritive substance & efficiency
- Formation of perfect biodiversity structure

Prospect of introducing agroforestry management

Strengthening of sci-tech for agroforestry methods
Improvement and strengthening of governmental guidance and management
Enhancement of producers' creativity
Governmental provides

Realizing greening & gardening,
Preservation of ecological environment,
Sustainable development of economy
11) Main Forest Pests and Control Measures in DPR Korea

Mr. Yong Il Pak
Director of Forest Breeding Research Institute,
Academy of Forest Sciences
Main forest pests and control measures in DPR Korea

Main forest pests in DPR Korea

- Pine caterpillar
- Pine nut sawfly
- Pine twig blight
- Cecidomyia brachyntera Sch. Maskell
- pine Leerya purchase
- 갓나무창포병
Great outbreak in 1960s and reduction in all areas except wetland.

Large outbreak from 2006 again and attack to pine trees throughout the country from 2007-2010

Outbreak of Cecidomyia brachyntera Sch.

Great outbreak in 1990s and reduction gradually.
Re-boost again from 2005 in central region of the country.
Damage to forests in Pyongyang City, North and South Hwanghae and Kangwon provinces in 2007-2009.
Outbreak of pine Leerya purchasi Maskell

Outbreak in Anmok River area of N. Phyongan Province for 10 years from 2000 and continue in long term

Outbreak of larch woolly-bear

Outbreak from 2010 in the area of Mt. Paektu of Ryanggang Province
Damage to Larix olgeinsis, Picea koraiences, Abies nephlorepis, Picea jezoensis
Great outbreak in 2012 and big damage to 2015
Outbreak of Acantholyda Sp.

Outbreak in south area of central region from 2005, Spread in S. Hamgyong and N. Phyongan provinces

Main forest disease

Outbreak from 2007
Spread gradually in all forests of pine and pine nut trees of south area in 2015
Outbreak of 소나무라엽병, 갓나무창포병 in 2010
Main Cause of Forest Pests Outbreak

- Rising of temperature
- Destruction of balance of forest ecosystem
- Spread of pine twig blight
- High rate of mono forest plantation

Control of Main Forest Pest

Use of natural enemy

- Ichneumonid, Trichogramma, predatory natural enemy
- Micro pesticide such as BT, Beauveria
- Plant pesticide such as celandine
Control of Main Forest Pest

**Physical and mechanical measures**

Light trap, attractive plant, mobile break band

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Control of Main Forest Pest

**Rational use of chemical pesticide**

Insecticide including delta, phospham
Fungicide including mancozeb, lime bordeaux
Further action for forest pest control

- Strengthening monitoring system of forest pest
- Data base of scientific information on outbreak and damage of forest pest,
- Appropriate application of ways and means for pest control
- Eco-environment protection based control strategy in a sustainable and safe way
- Improvement of function and role of forest ecosystem ,
- Application of comprehensive measures and proper control system
- Development of forest management technology for pest management
- Development and use of biological control measures

Introduction of IPM !

Thank You!
12) Breeding and Use of 1st Generation Hybrid of Key Species for Reforestation in DPR Korea

Mr. Yong Hun Ri
Researcher of Afforestation Research Institute, Academy of Forest Sciences
Breeding and use of 1st generation hybrid of key species for reforestation in DPR Korea

Breeding targets of first filial generation of key reforestation species

1. Species of high survival rate and fast growing capacity even on poor soil conditions
2. New genotype of strong resistance to winter damage and high productive property
3. Fruit and medicinal species to be contributed to human health care
**Pinus 1**
Fast-growing at young age and straight growth. Strong resistance to winter damage and dry soil.

**Pinus 2**
Slow-growing at young age and crooked growth. Normal resistance to winter damage and heavy pest damage.

**Populus 1**
Fast-growing and high soil requirement, floccus-stressing and weak resistance to winter damage.

**Populus 2**
Grow in mountainous land and strong persistence to winter damage, floccus staminate tree.

**Schizandra chinensis**
Grow well in humid land and not high soil requirement and winter-hardy plant.

15-year-old 1st generation hybrid in Pinus is usually 1.5m high, and it's lower as about 20% and also 3 times of pine cones when compare with the other stocks (7.4m).
**Castanea 1**
Early maturity and high yield. Weight of one chestnut is 15–17g and strong persistence to winter damage.

**Castanea 2**
Early maturity and high yield. Weight of one chestnut is 14–15g and strong persistence to winter damage.

**Larix 1**
Very strong persistence to winter damage and low soil requirement. Grow slowly and bear lots of seeds.

**Larix 2**
Normal persistence to winter damage and high soil requirement. Bear small amount of seed and grow fast. Native species from northern area.

**Larix 3**
Normal persistence to winter damage and high soil requirement. Bear small amount of seeds and grow fast. Native species from central area.

**Pinus bungeana**
Normal persistence to winter damage and soil requirement. 3–4m high, 3 leaves and grow branches from bottom, and bear small amount of seeds.
### Growing category of first filial generation in Pinus

<table>
<thead>
<tr>
<th>Description</th>
<th>5 year old tree-H (m)</th>
<th>5 year old tree-root neck-D (cm)</th>
<th>25 year old tree-uprightness-C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother tree</td>
<td>2.49 ± 0.021</td>
<td>5.4 ± 0.03</td>
<td>0.98 ± 0.002</td>
</tr>
<tr>
<td></td>
<td>2.13 ± 0.19</td>
<td>4.6 ± 0.02</td>
<td>0.71 ± 0.14</td>
</tr>
<tr>
<td>1st generation hybrid-1</td>
<td>2.95 ± 0.22</td>
<td>6.3 ± 0.5</td>
<td>0.96 ± 0.03</td>
</tr>
<tr>
<td>Comparison (%)</td>
<td>118.7</td>
<td>116.7</td>
<td>98.0</td>
</tr>
<tr>
<td></td>
<td>138.5</td>
<td>136.9</td>
<td>135.2</td>
</tr>
</tbody>
</table>

\[ K = \frac{u(B_1 + MP)}{B_2} \quad K(D) = 1.85, \quad K(C) = 2.20 \]

- \( K \) = hybrid force
- \( F_1 \) = cell of 1st generation hybrid
- \( P_1 \) = mother cell
- \( P_2 \) = father cell
- MP = mother and father cells

### Survey of pest damaged 1st filial generation in Pinus

<table>
<thead>
<tr>
<th>Species</th>
<th>No of surveyed trees</th>
<th>No of affected trees</th>
<th>Damage rate(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother and father</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pinus 1(♀)</td>
<td>36</td>
<td>6</td>
<td>16.7</td>
</tr>
<tr>
<td>Pinus 2(♂)</td>
<td>48</td>
<td>17</td>
<td>35.5</td>
</tr>
<tr>
<td>( F_1 )</td>
<td>(1)</td>
<td>59</td>
<td>2</td>
</tr>
</tbody>
</table>
## Heights per kinds of stocks of 15 year-old tree and productivities

<table>
<thead>
<tr>
<th>Kinds of stocks</th>
<th>Tree height (m)</th>
<th>Number of pine cones (pc/tree)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinus 1</td>
<td>7.4±0.9</td>
<td>4.6±1.8</td>
</tr>
<tr>
<td>Pinus F₁ (♂)</td>
<td>6.2±0.8</td>
<td>5.9±1.6</td>
</tr>
<tr>
<td>Pinus F₁ (♀)</td>
<td>1.5±0.6</td>
<td>14.8±2.5</td>
</tr>
<tr>
<td>Pinus 2</td>
<td>6.6±0.5</td>
<td>4.8±1.5</td>
</tr>
<tr>
<td>Pinus 3</td>
<td>7.1±0.4</td>
<td>5.2±1.1</td>
</tr>
</tbody>
</table>

## 1st fillial generation of Populus

<table>
<thead>
<tr>
<th></th>
<th>Height (m)</th>
<th>Diameter (cm)</th>
<th>Annual mean temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>♀</td>
<td>♂</td>
<td>♀</td>
</tr>
<tr>
<td>M and F tree</td>
<td>12.2±1.8</td>
<td>14.7±2.6</td>
<td>18.6±2.8</td>
</tr>
<tr>
<td>1st generation hybrid-♀</td>
<td>16.8±1.9</td>
<td>23.6±2.3</td>
<td>6–7</td>
</tr>
<tr>
<td>Comparison (%)</td>
<td>137.7</td>
<td>114.3</td>
<td>126.9</td>
</tr>
</tbody>
</table>

*Age: 12yr old, K(H)=2.94, K(D)=2.22*
### 1st Fillial Generation in Larix

<table>
<thead>
<tr>
<th></th>
<th>Height (m)</th>
<th>Diameter (cm)</th>
<th>20 year old conifer-P (pc)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>♀</td>
<td>♂</td>
<td>♀</td>
</tr>
<tr>
<td>M and F tree</td>
<td>10.6±0.8</td>
<td>9.2±0.6</td>
<td>12.9±0.4</td>
</tr>
<tr>
<td>1st generation hybrid II</td>
<td>12.8±0.8</td>
<td>13.8±0.6</td>
<td>98±19</td>
</tr>
<tr>
<td>Comparison (%)</td>
<td>120.8</td>
<td>139.1</td>
<td>107.0</td>
</tr>
</tbody>
</table>

### Another Hybrid Generation of Larix 1 × Larix 2

<table>
<thead>
<tr>
<th></th>
<th>Height (cm)</th>
<th>Diameter (cm)</th>
<th>20 year old conifer-P (pc)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>♀</td>
<td>♂</td>
<td>♀</td>
</tr>
<tr>
<td>M and F tree</td>
<td>94.1±0.9</td>
<td>101.3±0.7</td>
<td>1.8±0.3</td>
</tr>
<tr>
<td>Next generation of 1st hybrid</td>
<td>145.7±3.8</td>
<td>3.7±0.6</td>
<td>52.2±4.1</td>
</tr>
<tr>
<td>Comparison (%)</td>
<td>154.8</td>
<td>143.8</td>
<td>205.6</td>
</tr>
</tbody>
</table>
1. 1st fillial generation between Pinus 1 and Pinus 2 grow fast in early days and upright and high resistance to pest damage. In particular, Pinus $F_1$ (II) has great availability of using grafting branch of short pine nut.

2. 1st fillial generation in Populus grow well in mountainous area and floccusless so as to improve socio and economic value.

3. 1st fillial generation between Larix 1 and Larix 2 grow fast and is strong persistence to winter damage and high seed production yield.

4. 1st fillial generation in Castanea is very strong persistence to winter damage and applicable to non-cultivated area as a prematurity and winter-hardy species.

5. Breeding for increment of the economic value of the medicinal fruit trees such as Crataegus, Evold, Schizandra, White nut, should be considered.
Thank you!
13) Outlook on Propagation, Cultivation and Prospection for Introduction of Vitamin Tree No.4 at the Northern Areas of Ryanggang Province in DPR Korea

Mr. Kwang Il Pok
Officer of External Economic Cooperation Department, MoLEP
Outlook on propagation, cultivation and prospection for introduction of Vitamin tree No.4 at the northern areas of Ryanggang Province in DPR Korea

The Korean name(비타미나무/Vitamin tree) of seabuckthorn (Hippophae rhamnoides) with high economic value was given by the President Kim Il Sung on 4th April, 1992. As the fruits and leaves of sea buck thorn contain plenty of various vitamins like A, B, C, D, E, P etc. amino acids and minor elements, they have a great significance in wellbeing of people and development of foodstuff industry. We summarized the outlook of a new sea buck thorn(vitamin tree No. 4 from now) cultivar to propagate and introduce into production in northern area of Ryanggang Province.
1) Propagation of “Vitamin tree No.4”
   ① Propagation by hardwood cutting

Growth amount and rooting rate of hardwood (old) cuttings with different age of vitamin tree

<table>
<thead>
<tr>
<th>Age of scion, year</th>
<th>Number of scion</th>
<th>Number of rooted scion</th>
<th>Rooting rate, %</th>
<th>Growth amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>height, cm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Diameter of root collar, mm</td>
</tr>
<tr>
<td>1</td>
<td>1000</td>
<td>774</td>
<td>77.4</td>
<td>55.4</td>
</tr>
<tr>
<td>2</td>
<td>1000</td>
<td>369</td>
<td>36.9</td>
<td>46.7</td>
</tr>
</tbody>
</table>

*Main substance of cutting bed: sand. Length of cuttings: 12 ~ 15 cm. Diameter: 0.5 cm ≤
Propagation by greenwood cutting

Growth amount and rooting rate of greenwood cutting with different age of vitamin tree.

<table>
<thead>
<tr>
<th>Kind of scion</th>
<th>Number of scion</th>
<th>Rooted scion</th>
<th>Rooting rate, %</th>
<th>Growth amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>height, cm</td>
</tr>
<tr>
<td>lignified</td>
<td>1,000</td>
<td>447</td>
<td>44.7</td>
<td>21.5</td>
</tr>
<tr>
<td>Semi-lignified</td>
<td>1,000</td>
<td>894</td>
<td>83.4</td>
<td>22.5</td>
</tr>
<tr>
<td>Non-lignified</td>
<td>1,000</td>
<td>113</td>
<td>11.3</td>
<td>20.9</td>
</tr>
</tbody>
</table>
2) Introduction of sea buck thorn cultivar

① Soil condition of pilot site

<table>
<thead>
<tr>
<th>site</th>
<th>Soil Condition</th>
<th>Humidity</th>
<th>Humus content, %</th>
<th>Soil depth, cm</th>
<th>Relative location</th>
<th>Slope grade, °</th>
<th>azimuth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyesan</td>
<td>clay loamy</td>
<td>Arid</td>
<td>2～3</td>
<td>50&lt;</td>
<td>Hill side</td>
<td>11.0</td>
<td>sunny</td>
</tr>
<tr>
<td>Tachongdan</td>
<td>Volcanic soil</td>
<td>moderate</td>
<td>3&lt;</td>
<td>40～50</td>
<td>Hill side</td>
<td>9.0</td>
<td>Semi sunny</td>
</tr>
<tr>
<td>Samjiyon</td>
<td>Volcanic soil</td>
<td>arid</td>
<td>2～3</td>
<td>20～30</td>
<td>Top of hill</td>
<td>10.0</td>
<td>sunny</td>
</tr>
<tr>
<td>Unhung</td>
<td>loamy</td>
<td>moderate</td>
<td>2～3</td>
<td>50&lt;</td>
<td>Foot of hill</td>
<td>10.0</td>
<td>sunny</td>
</tr>
</tbody>
</table>

② Wintering rate of cultivar in pilot sites

<table>
<thead>
<tr>
<th>site</th>
<th>Age of tree, year</th>
<th>Minimum temperature, °C</th>
<th>Length of shoot, cm</th>
<th>Length of frozen branch, cm</th>
<th>Wintering rate, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyesan</td>
<td>9</td>
<td>-31.0</td>
<td>20.4±2.1</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>Tachongdan</td>
<td>12</td>
<td>-32.5</td>
<td>18.5±1.4</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>Samjiyon</td>
<td>2</td>
<td>-36.9</td>
<td>30.6±2.5</td>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>Unhung</td>
<td>4</td>
<td>-31.5</td>
<td>44.5±2.7</td>
<td>0</td>
<td>100.0</td>
</tr>
</tbody>
</table>
3 Growing category of cultivar in pilot site

<table>
<thead>
<tr>
<th>site</th>
<th>Age of tree, year</th>
<th>Height, m</th>
<th>Diameter of stump, mm</th>
<th>Diameter of crown, m</th>
<th>Length of young branch, cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyesan</td>
<td>9</td>
<td>2.4±0.2</td>
<td>9.8±0.6</td>
<td>1.5±0.2</td>
<td>20.4±2.1</td>
</tr>
<tr>
<td>Taehongdan</td>
<td>12</td>
<td>2.6±0.2</td>
<td>13.2±1.3</td>
<td>1.5±0.2</td>
<td>18.5±1.4</td>
</tr>
<tr>
<td>Samjiyon</td>
<td>2</td>
<td>0.8±0.1</td>
<td>1.8±0.3</td>
<td>0.6±0.1</td>
<td>30.6±2.5</td>
</tr>
<tr>
<td>Unhung</td>
<td>4</td>
<td>1.5±0.1</td>
<td>5.1±0.3</td>
<td>1.1±0.1</td>
<td>44.5±2.7</td>
</tr>
</tbody>
</table>
### Fruition property of cultivar in pilot sites

**Table6**

<table>
<thead>
<tr>
<th>site</th>
<th>cultivar</th>
<th>mass, g</th>
<th>Yield amount</th>
<th>Control, times</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1fruit</td>
<td>100fruit</td>
<td>Kg/1tree</td>
</tr>
<tr>
<td><strong>Hyesan</strong></td>
<td>Vitamin tree No.4</td>
<td>0.68</td>
<td>62.0</td>
<td>7.7</td>
</tr>
<tr>
<td></td>
<td>Origin Vitamin tree</td>
<td>0.65</td>
<td>60.0</td>
<td>5.9</td>
</tr>
<tr>
<td><strong>Taehongdan</strong></td>
<td>1</td>
<td>0.68</td>
<td>63.0</td>
<td>8.0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.65</td>
<td>60.0</td>
<td>6.2</td>
</tr>
</tbody>
</table>

* Origin Vitamin tree: called as “Vitamin tree No.1”*
Conclusion

1. Our cultivar can be propagated by green wood and hard wood cutting.
   - Survival rate of hardwood cutting is 77.4% at 1 year old slip and 36.5% at 2 years old one so it’s prefer to use 1 year old one.
   - The survival rate of green wood cutting is the highest at semi-lignified branch as 83.4% and it is too low at non-lignified branch as 11.3% to 44.7% so it’s prefer to use green wood as slip cutting.

2. Wintering ability of Vitamin tree No. 4 is so perfective that growing and fruiting rates are very reasonable in Hyesan, Tachongdan, Unhung and Samjiyon, Northern area of our country.
   - At the pilot sites in northern areas of Ryanggang Province, the growth characteristics is good exceptionally.
   - The fruit yield through our trial cultivation is about 1.3 times more than control one in comparing with control one as the one fruit mass of ours is 0.68g, fruit yield amount of per hectare is 9.8~10.4kg at 8 years old tree but it is 7.7 ~ 8.0 t in case of control one.
THANK YOU!
III. Photos
Opening & Presentation Session
10-11 April 2018, Beijing
Table 1: Characteristics of 'Vitamin Tree Seed' in different years

<table>
<thead>
<tr>
<th>Age of seed</th>
<th>Number of cones</th>
<th>Number of seeds</th>
<th>Seedling height</th>
<th>Seedling width</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,000</td>
<td>124</td>
<td>77.4</td>
<td>55.4</td>
</tr>
<tr>
<td>2</td>
<td>1,096</td>
<td>169</td>
<td>84.9</td>
<td>48.7</td>
</tr>
</tbody>
</table>

* All values are in cm.
Field Trip
12 April 2018, Ordos
Organizer Contact

Dr. Ho Sang Kang
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International Workshop on Forest Landscape Restoration and Resilience to Climate Change in Northeast Asia

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