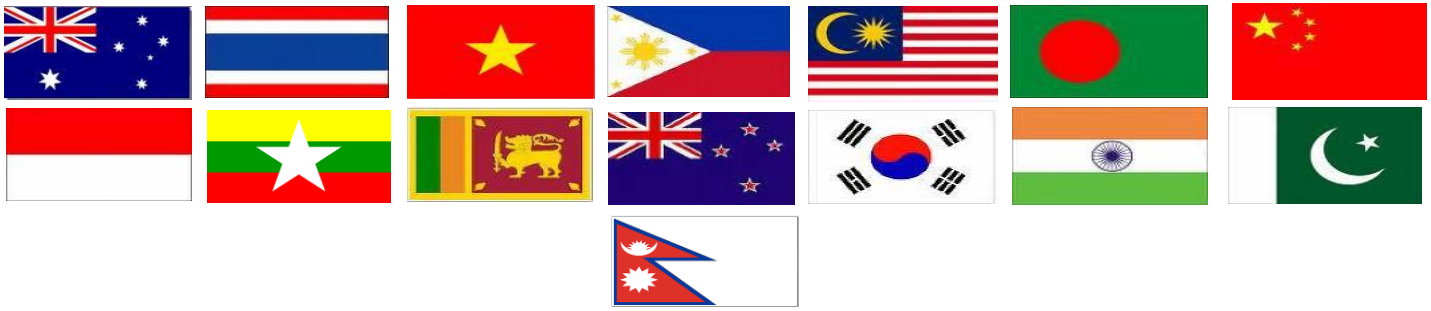
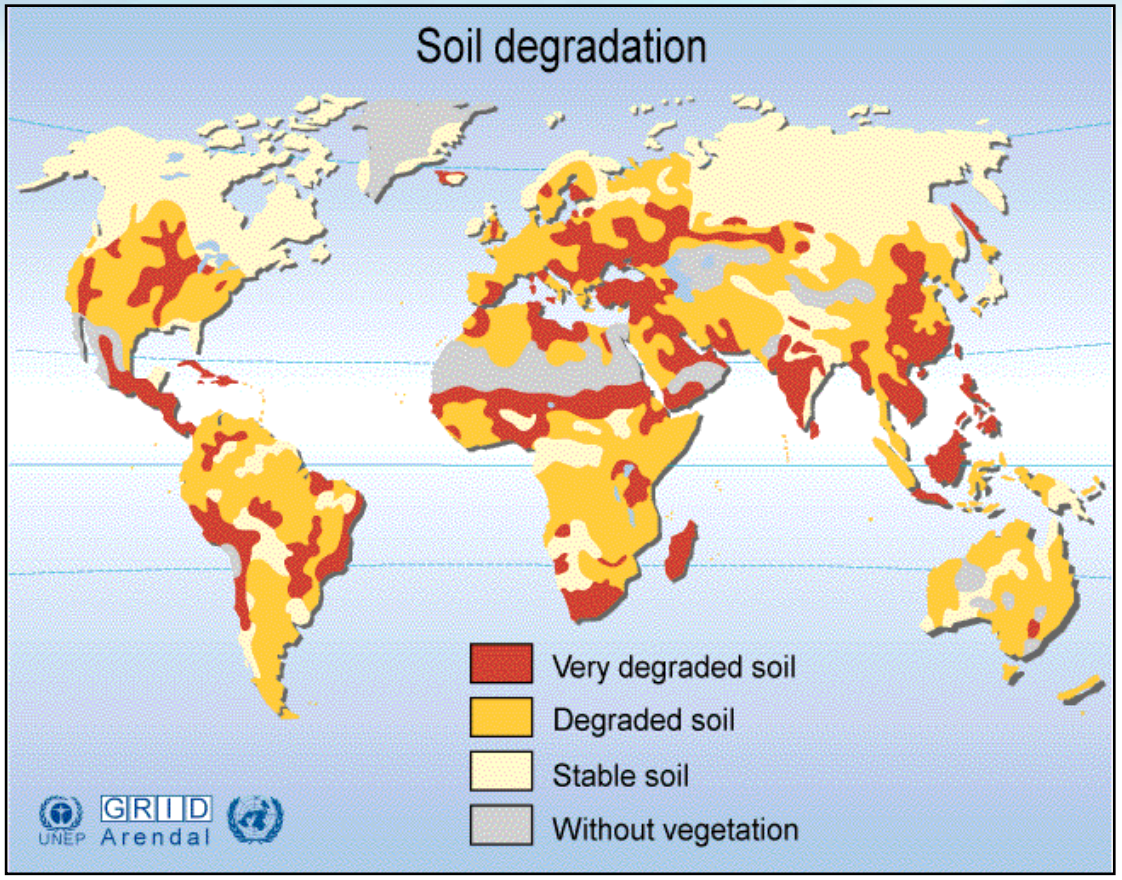
Improving Soil Fertility, Land Productivity and Land Degradation Mitigation (RAS/5/055)

- 2012 – 2015
- LCC: Prof Henk Heijnis, ANSTO
- 15 participating Member States



Introduction

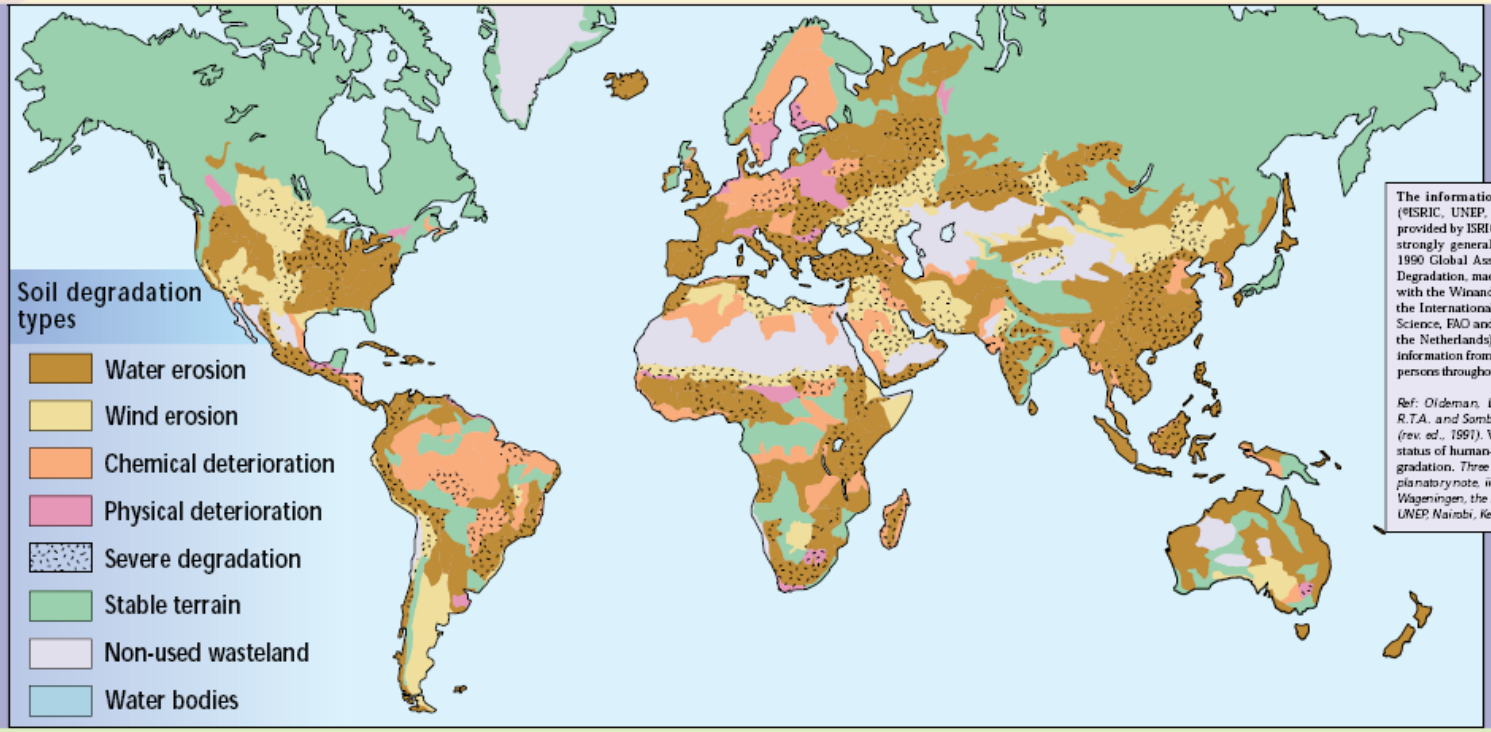
- Soil degradation is affecting 1.9 billion ha (65% of the global soil resources) and is increasing at a rate of 5 to 7 million ha/yr.
- Soil erosion, one of the main degradation process, is a serious agri-environmental problem.
- Since 1960, one-third of the world's arable land have been lost through erosion.
- Erosion rate is 10 to 20 times faster than the soil is being replenished (i.e. soil formation is a very slow process of max 0.5-1 t/ha/yr)!
- Limited soil resources, inappropriate land management and rapid population growth are making the soil more prone to erosion.
- **Climate change further increases the risk of soil erosion.**



80% of degraded land is located in developing countries !

WORLD FOOD SUMMIT
Rome
13-17 November 1996

Human-induced soil degradation



ISRIC

The information for this map (©ISRIC, UNEP, FAO 1996) was provided by ISRIC and UNEP. It is strongly generalized from their 1990 Global Assessment of Soil Degradation, made in cooperation with the Winand Staring Centre, the International Society of Soil Science, FAO and ITC (Enschede, the Netherlands), with help and information from several hundred persons throughout the world.

Ref: Oldeman, L.R., Hakkeling, R.T.A. and Sombroek, W.G. 1990 (rev. ed., 1991). World map of the status of human-induced soil degradation. Three maps and an explanatory note. iii + 34 pp. ISRIC, Wageningen, the Netherlands, and UNEP, Nairobi, Kenya.

UNEP

Human activities have often led to degradation of the world's land resources, which are the basis for sustained food security. The global assessment of human-induced soil degradation (GLASOD) has shown that damage has occurred on 15 percent of the world's total land area (13 percent light and moderate, 2 percent severe and very severe), mainly resulting from erosion, nutrient decline, salinization and physical compaction. These impacts frequently lead to reductions in yields. Land conservation and rehabilitation are essential parts of sustainable agricultural development. While severely degraded soil is found in most regions of the world, the negative economic impact of degraded soil may be most severe in the countries most dependent on agriculture for their incomes.

Key Outcome

Enhancement of national and regional capacities in application of nuclear and isotopic techniques for increased land productivity and sustainable land use in the Asia-Pacific Region under a changing climate.

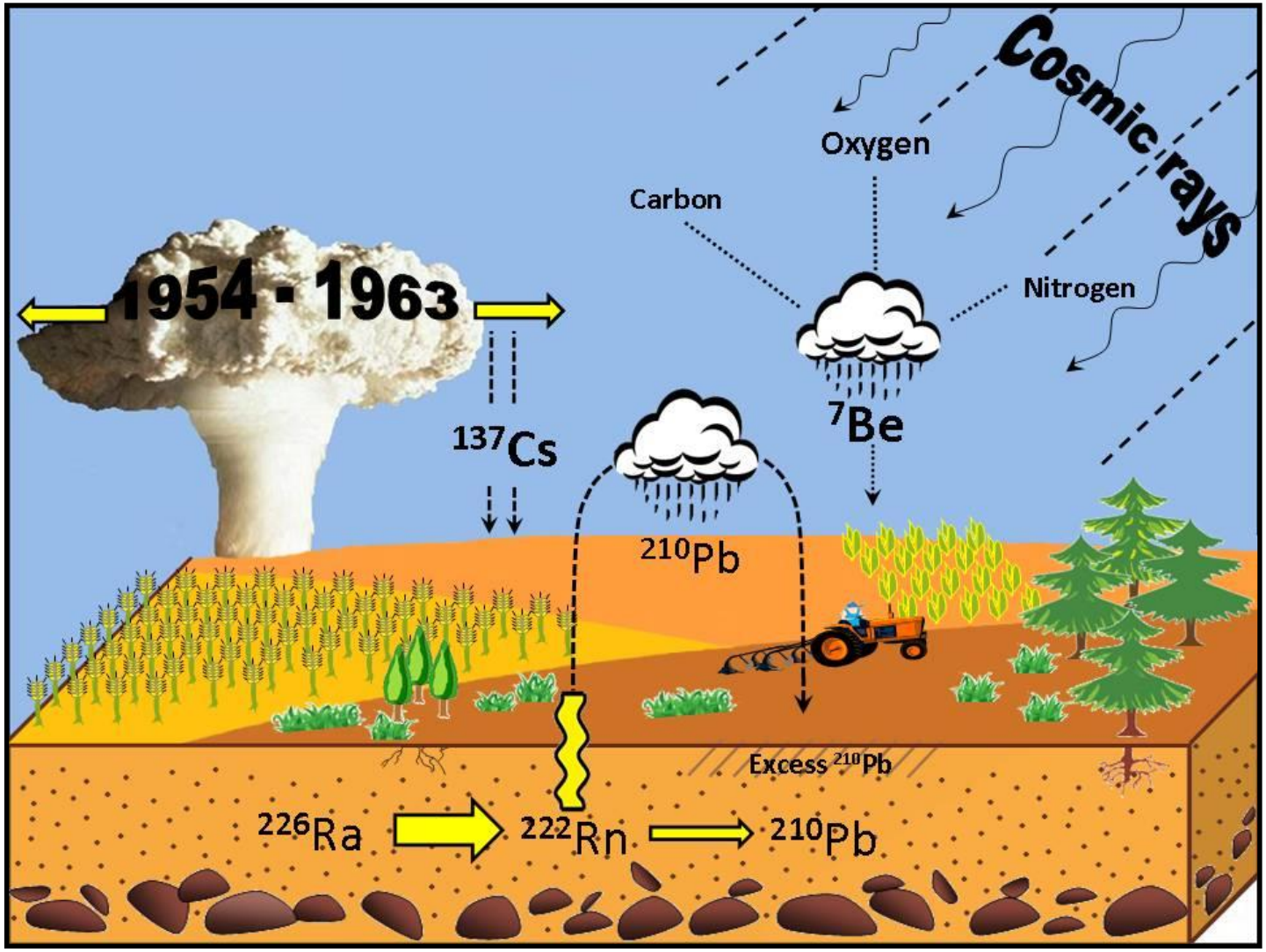
Specific Outcomes

1. Adoption of specific strategies for enhanced and sustainable land productivity based on improved understanding of land degradation due to land use changes, human intervention and climate change in a range of agro-ecosystems of the region
2. Established regional database on isotopic signatures of crop and soil compounds (Isoscapes) in the region
3. Enhanced partnership with end-users and external institutions and key partners

Methodology

- Fallout Radionuclides (FRNs) technique to quantify soil erosion rate at the field scale
- Compound-Specific Stable Isotope (CSSI) is a forensic tool using Compound-Specific Stable Isotopic Analysis (CSIA) data to identify soil sources
- To enable up-scaling to catchment-scale sediment management and identification of sediment sources
- Establishment of a regional database on isotopic signatures of crop and soil compounds (isoscapes)

Radionuclides in Soils



Carbon isotopes in C_3 and C_4 plants

Plants can be grouped according to ^{13}C discrimination

C3 plants: d ^{13}C = -26 ‰

$^{12}CO_2$

(99%)

$^{13}CO_2$

(1%)

rice, wheat,

forest, vegetation

C4 plants: δ ^{13}C = -12 ‰

maize, sorghum, sugarcane,

some tropical herbs

Joint FAO/IAEA Programme

Nuclear Techniques in Food and Agriculture

Project activities in 2014

Meetings

TM to Agree on the Establishment and Maintenance of CSSI and FRN Databases of the Region: *8-12 Sept, Kathmandu (NEP)*

Expert Missions

- Yong Li (CPR) - Enhancing Nepal's ability in soil FRN and CSSI samplings: *14 - 25 April, Kathmandu (NEP)*
- Yong Li (CPR) - Improving Soil Fertility, Land Productivity and Land Degradation Mitigation: *28 April – 9 May, Mandalay (MYA)*

Progress in 2014

Outcome 1. Adoption of specific strategies

Functional network using FRNs & CSSI Techniques

Most members established FRNs capability and, with the help of CPR, access to CSSI analysis.

Capacity building

- Via specific workshops and training (FRNs and CSSI).
- Member states assisting each other.
- CPR helping GPs with the interpretation of CSSI results – SOPs on soil sampling have been developed.

Progress in 2014

Outcome 2. Regional database on isoscapes

- Templates developed at TM in Kathmandu – FRN; CSSI
- VIE demonstrated use of template
- FRNs data – Cs-137, Pb-210, Be-7 - reference inventory
- Central repository – IAEA, Dr Zaman, coordinating – 6 monthly updates from participating GPs via IAEA portal
- CSSI data – input and training by CPR appreciated

Progress in 2014

Outcome 3. Enhanced partnership with end-users

- Final contributing activities planned during 2015.
- About six GPs have already transferred data.

Issues

- Limited feedback on use of Be-7
- CSSI:
  - Need for development of a different strategy with respect to sampling and data interpretation
  - application to soil erosion is relatively new
  - extra assistance planned for GPs new to CSSI or have problems with interpretation

Activities and inputs planned 2015

- Regional training on conservation agriculture, CSSI and FRNs in Kathmandu, Nepal 7-12 June 2015
- Final progress review meeting in Malaysia, Nov 2015
- Interpreted results available to end users in the respective countries by end 2015
- Site demonstration visits for key stakeholders and decision makers in Nov 2015 Vietnam
- Collection of awareness documentation for key stakeholders and decision makers
- Support for additional FRNs and CSSI sample analyses
- Overview paper to high impact journal

Comments and Questions