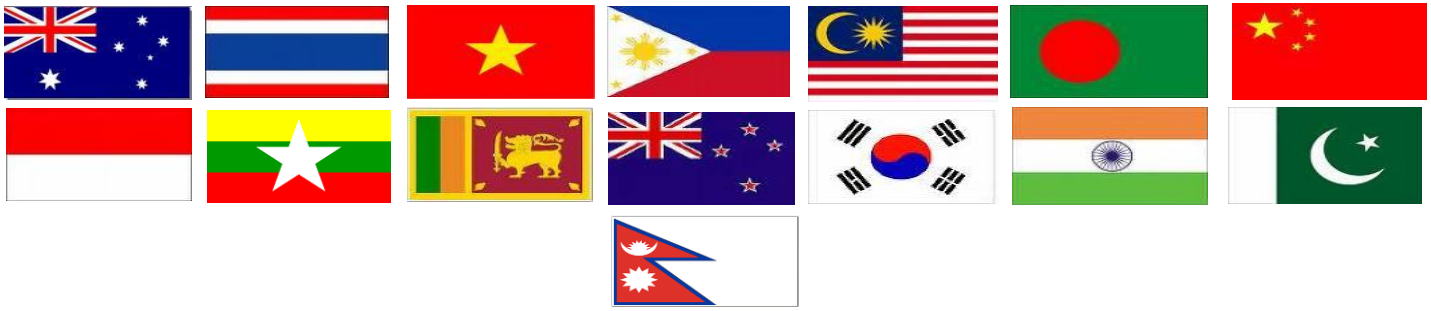
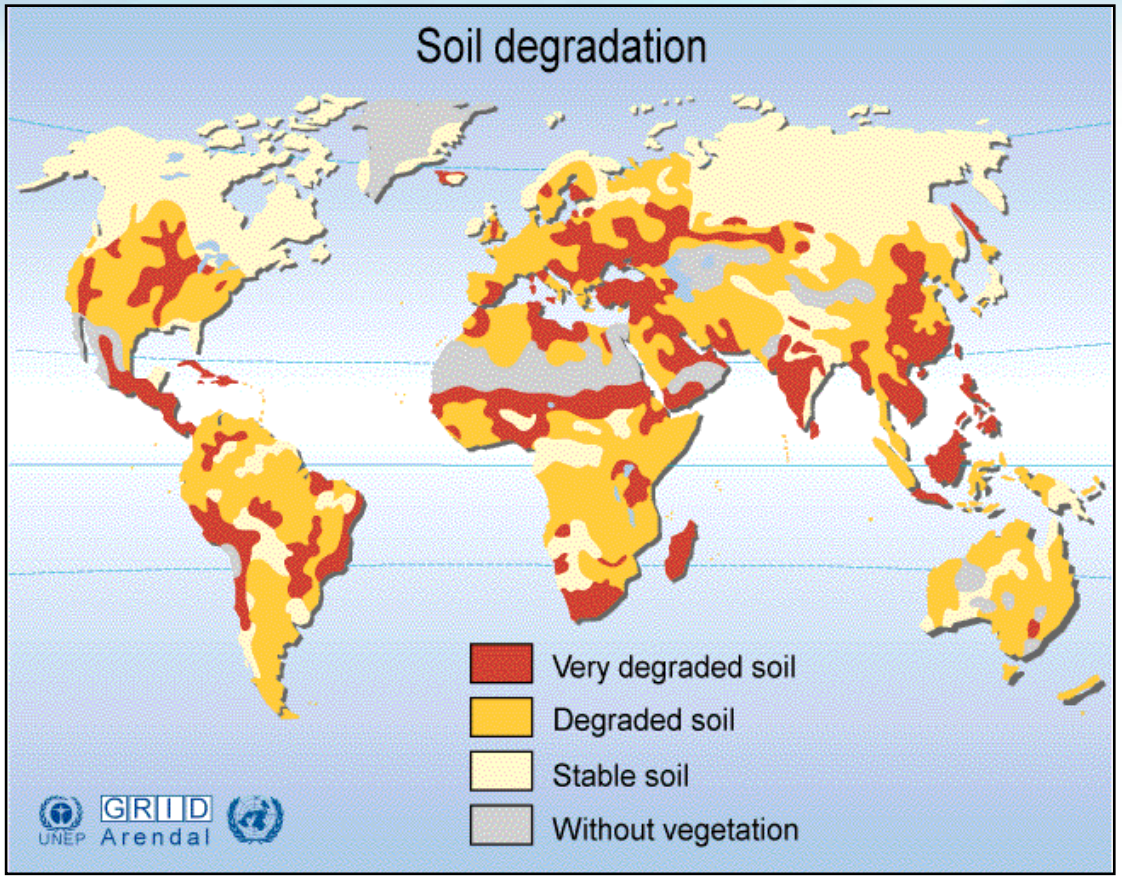
Improving Soil Fertility, Land Productivity and Land Degradation Mitigation (RAS/5/055)

- 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 !

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.

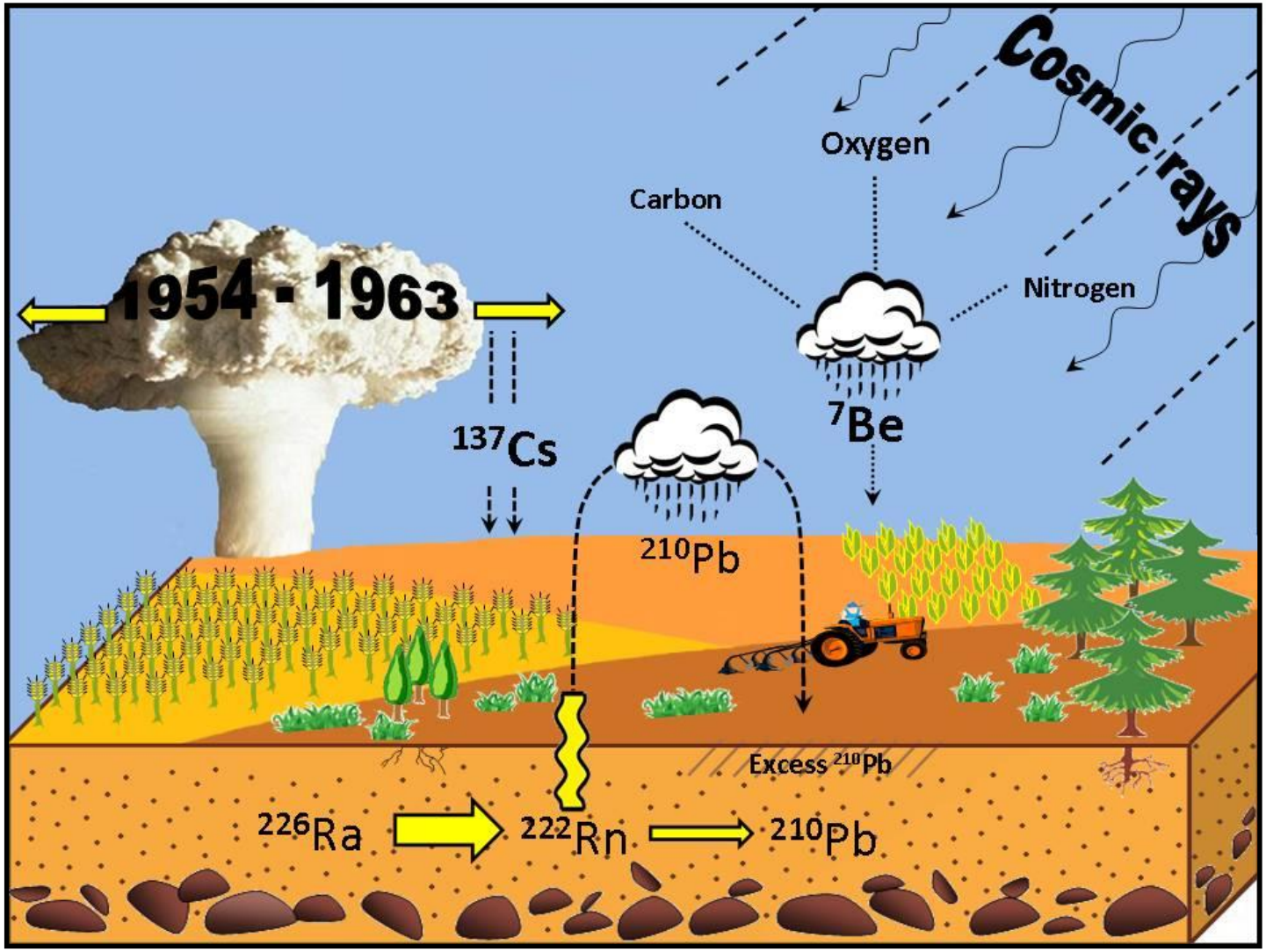
Specific Outcomes

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

FAO FIAT PANIS

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Joint FAO/IAEA Programme

Nuclear Techniques in Food and Agriculture

Project activities in 2015

Meetings

- Final Project Review Meeting: 4-7 Nov - MAL
- Regional Workshop on Demonstration of the Role of Nuclear Techniques in Conservation Agriculture: 1-2 Nov, VIE

Training courses

- RTC on integrated soil conservation practices to mitigate soil erosion and the role of nuclear techniques : *27-31 July, SRL*

Outcomes for 2015

- Focus – knowledge transfer to endusers → farmers; regulators
- KL meeting - developed strategies to engage with key stakeholders
- Dalat meeting - included participation by stakeholders – seminars on nuclear techniques in shaping mitigation measures, plus field visit to demonstration site

Project Achievements

Output 1: *Functional network using FRN and CSSI*

- Linkages and functional teams developed between 'knowledge' organisations and endusers

Output 2: *Capacity Building*

- FRN - focussed on case study design, field sampling, modelling of results (RTCs, expert missions)
- CSSI - fingerprinting sources of land degradation and soil erosion
  - effective networking and support from CAAS provided capacity in some GPs

Project Achievements

Output 3: *Regional database established on isotopic signatures of crop and soil compounds (iso-scapes)*

- Established in 2014 - collection ongoing
- Will provide a regional overview of land degradation, soil erosion and effectiveness of mitigation measures
- Journal publication to test scientific robustness
- Need to develop a format more suitable for endusers

Project Achievements

Output 4: *Efficient and effective project coordination, networking and knowledge transfer to endusers*

- Coordination meetings well-attended
- Knowledge transfer to endusers at various levels - KL and Dalat events particularly useful
- Networks developed between technique specialists and endusers will ensure sustainability on agricultural practices

Lessons Learned

- FRNs have great potential to measure soil redistribution and sedimentation rates within catchments, and patterns in lakes/ reservoirs
- CSSI supporting tool to FRN in identifying the most severely degraded sites
- Networking invaluable - GPs sharing experiences and expertise in varying environments and climatic conditions

Recommendations

- National level - close collaboration/ networking among scientific institutions, stakeholders and endusers must be maintained in promoting the application of FRNs and CSSI
- SOC measurements should be incorporated in FRN studies
- Wind erosion studies in future programs
- Maintenance of the regional database to ensure recommendations can be made to GPs to mitigate land degradation and improve soil productivity
- Continue capacity building to promote the use of FRNs, CSSI and geochemical techniques
- Continued CSSI analysis support - TCDC

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

Comments and Questions