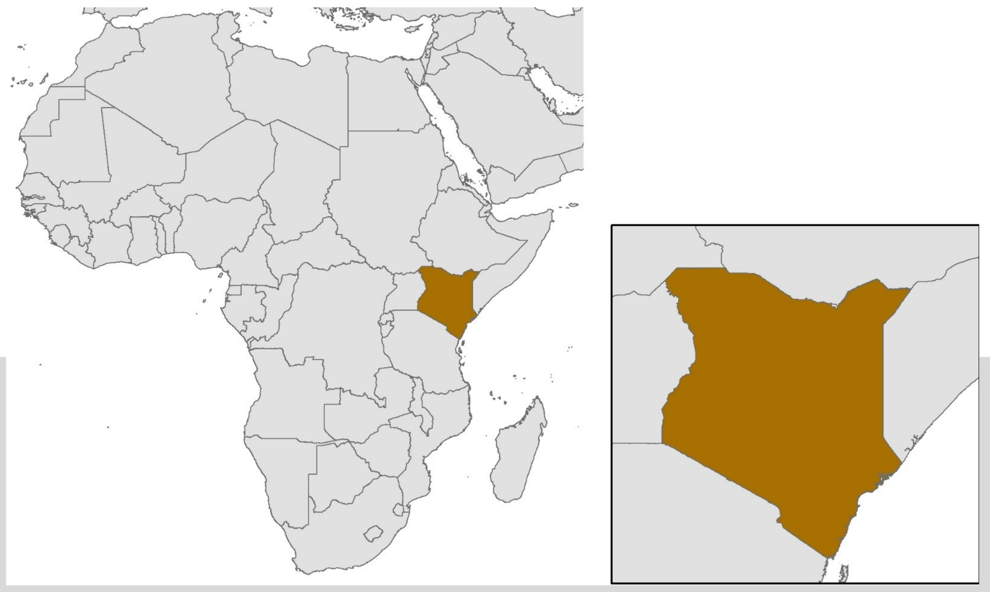

Multi-temporal Soil Erosion Risk Modelling over Kenya with Multi-Sensor Earth Observation & Ancillary Data

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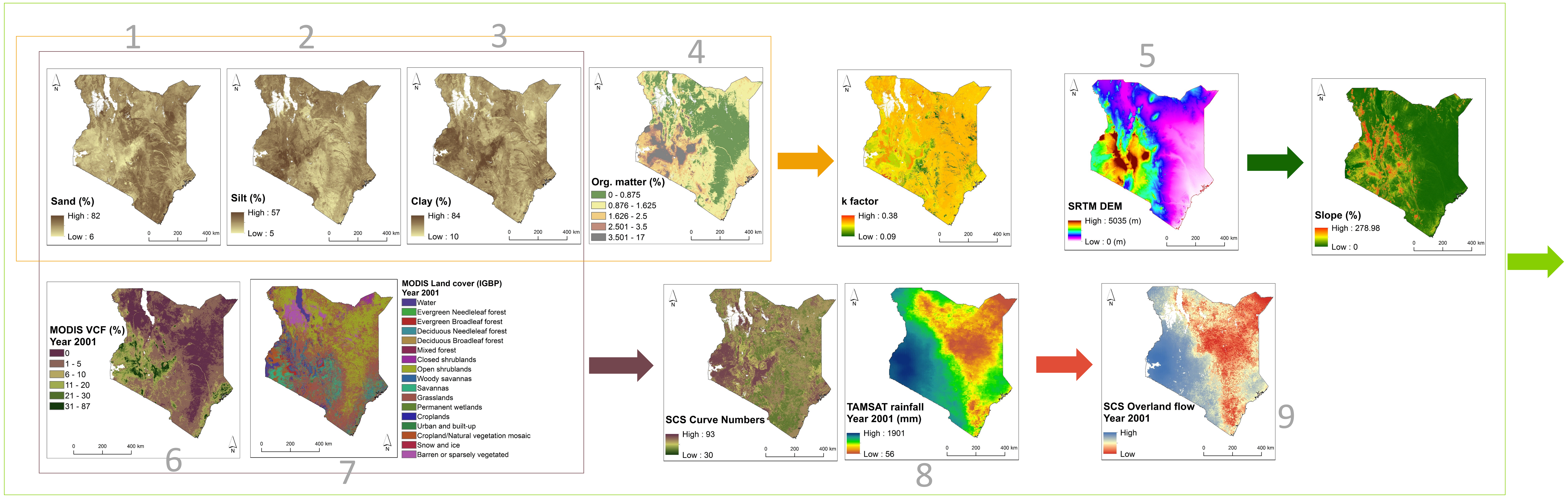
Rationale

- Accelerated soil erosion is the principal cause of soil degradation across the world. In Africa, it is seen as a serious problem creating negative impacts on agricultural production, infrastructure and water quality
- In Kenya, soil erosion and land degradation have become major environmental concerns and present a formidable threat to food security and sustainability of agricultural production. Over the period 1981–2003, despite improvements in woodland and grassland, productivity declined across 40% of cropland – a critical situation in the context of a doubling of the human population over the same period
- Traditionally, soil losses by water erosion have been estimated using runoff plot measurements and a wide range of erosion models. The runoff plot experiments are not only resource demanding to undertake but also are site-specific and only quantify factors that are responsible for erosion processes (Mutchler et al., 1994, Morgan, 1996 and Stroosnijder, 2003)
- It is important that a soil erosion monitoring system for Kenya is in place in order to understand the magnitude of, and be able to respond to, the increasing number of demands on this renewable resource
- We propose a methodology for the mapping of sheet-wash soil erosion risk on a yearly time-step using multi-temporal & multi-sensor Earth Observation & ancillary data in a GIS

http://www.nationsonline.org/oneworld/map/kenya_map2.htm
11

Data

- **SOILS**: **ISRIC** African SoilGrids, **250m**
  - Sand (%), silt (%), clay (%), organic matter (%) (Fig. 1 to 4)
- **DEM:** SRTM DEM, **90m** (Fig. 5)
- **LAND COVER:**
  - MODIS ***MOD44B Vegetation Continuous Fields*** (sub-pixel-level representation of surface vegetation cover estimates), Yearly, **250m** (Fig. 6)
  - MODIS ***MCD12Q1 Land Cover Type***, Yearly, **500m** (Fig. 7)
- **PRECIPITATION:** University of Reading, TAMSAT **Meteosat**-based seasonal rainfall estimates (0.0375° = ~**4km**) (Fig. 8)



Period of study

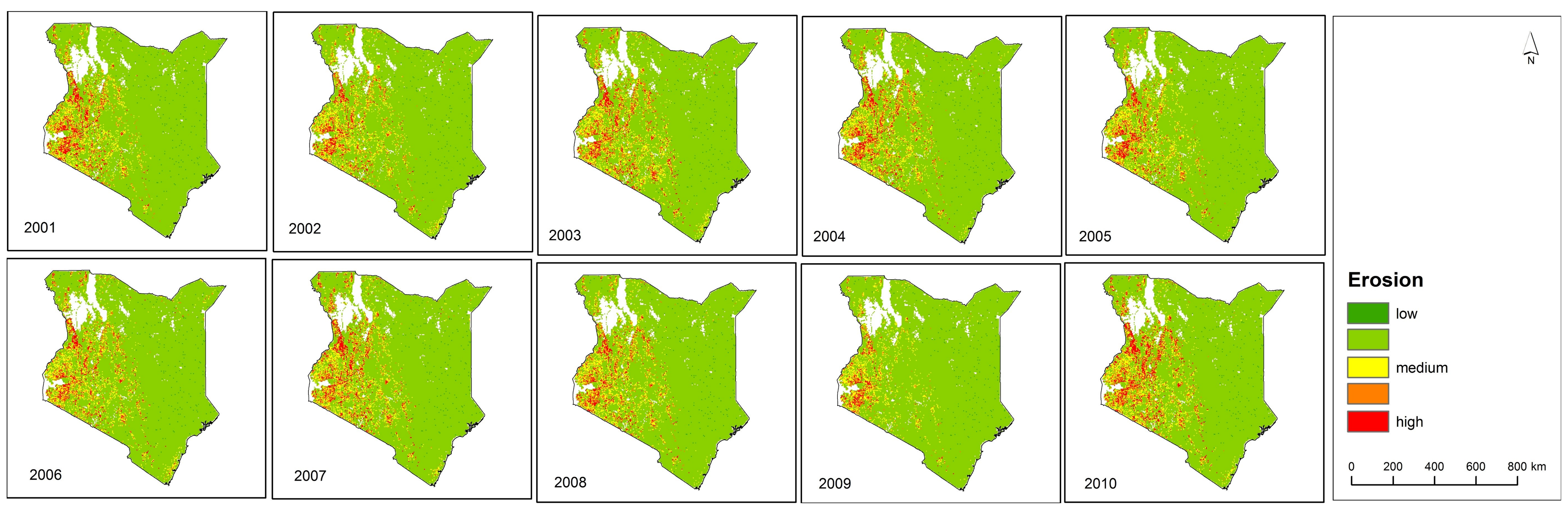
- 10 years, 2001-2010, on a yearly basis

Methods (Symeonakis and Drake 2010)

- Thornes (1990) sheet-wash erosion and SCS (1972) overland flow models:

$$E = k\,Q^{2}\,s^{1.67}\,e^{-0.07vc}$$ (Fig. 10)

E: erosion (mm)
K: soil erodibility coefficient
Q: overland flow (mm; SCS 1972; Fig. 9)
s: slope (%)
Vc: vegetation cover (%)



10

Results

Throughout the 10 years, the areas that are flagged as of higher risk from soil erosion are in the west of the country, specifically around (fig. 11):

- **A: Nakuru, Kisii and Kericho**
- **B: Lokori, Lokichar and Lodwar**
- **C: Marigat, Lake Baringo and Maralal**

'Worse' year: 2010, 'best' year: 2009

Results in agreement with GLASOD data on 'loss of topsoil by water erosion: Wt' (Oldeman et al., 1992)

- Cross-tabulation of the severity and GLASOD subsets gave a significant Cramer's correlation coefficient of 0.78 (P << 0.005).

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