# *Vetiver Systems on-farm: soil & water conservation, flood protection, and other benefits*

Presented in Addis Ababa, Ethiopia, March 2009

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# Content

1. Farmers facing environmental challenges
2. Vietnam: cassava (crop-package)
3. Bali, Indonesia: schools, community
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5. In plains: flood damage control
6. In semi-arid areas
7. Other uses: fodder, pest control, handicraft

# 1. Farmers facing environmental challenges

1.1 Climate change

- heavier storms: erosion, landslides, flood damage to farms, dam siltation
- more droughts: longer dry spells, water infiltration decreased

1.2 Unsustainable farming

- on marginal lands, deforestation
- soil degradation (depletion, alkalinisation)
- flood damage to crops
- water source depletion
- water pollution (agro-chemicals)

# *Problems I: crops lack water & fertility*

- Africa: cereal yield ¼ global average
- Machakos farmer: toughest challenge are regular **water supply** (& pests) (source AGRA UPDATE vol.1 #1)
- Kenya fertilizer prices soared **(1700 → 6000 Ksh/bag,** source: Daily Naiton 30-11-2008**)**
- Kenya land shortage causing conflict; chronic underproduction increases need for land

# *Problems II: soil & water lost to erosion*

- Kenya: annually lost soil value 3 - 4 times higher as annual income from tourism!

  → adding fertilizer is increasingly inefficient

  '97-'07: maize yield increase 6.6 → 9.3 bags/acre but:

  now yields (expected to) decrease

- Western Kenya:

  - since 1963: 3.2 million t soil washed into L. Victoria (1m truckloads)

  - Nyando river basin soil loss: US$42.7 million yearly (based on US$12/t)

  - soil degradation: much land abandoned

# *The other side of the problem*

- Kenyans have least access to safe water in East Africa: 647 m3 / citizen (Tanzania 3000, Uganda 2700)
  (source: IRIN news 16-9-2002)
- 75% of people in Kenyan hospitals would not be there if they had access to (safe) drinking water
- Pursuit of water prevents women to engage in productive activities, children to go to school

→ *Poverty*

# Mt Kenya streams depleting

## Problem: land use more intensive

- more surface runoff and floods, less water stored in mountain
- more irrigation (*but: smallholder farms on more fertile higher slopes generally use less water*)

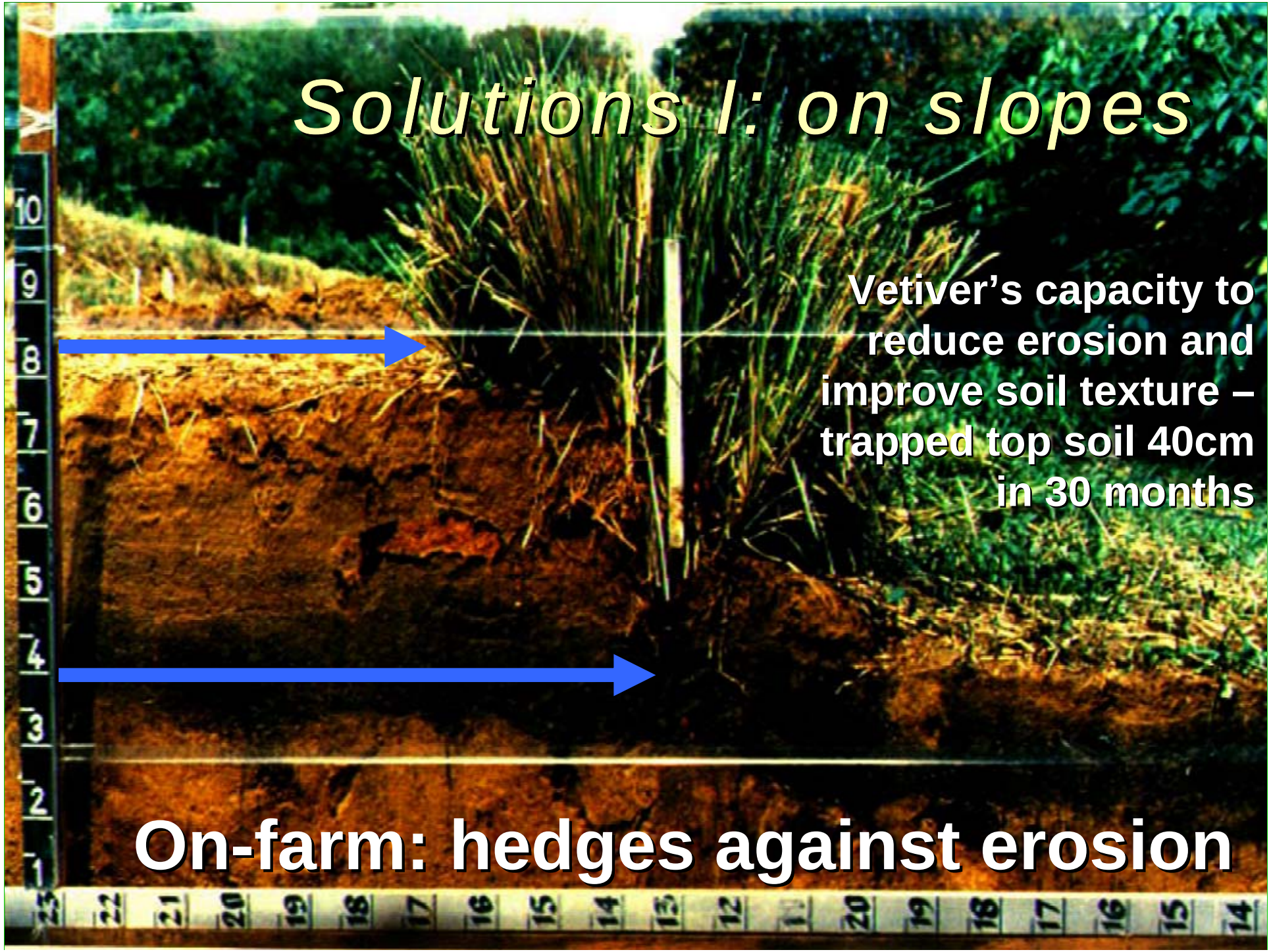
**Consequence**: water shortage in dryer areas (towards Wajir) and less water for pastures

→conflicts on water resources, pasture

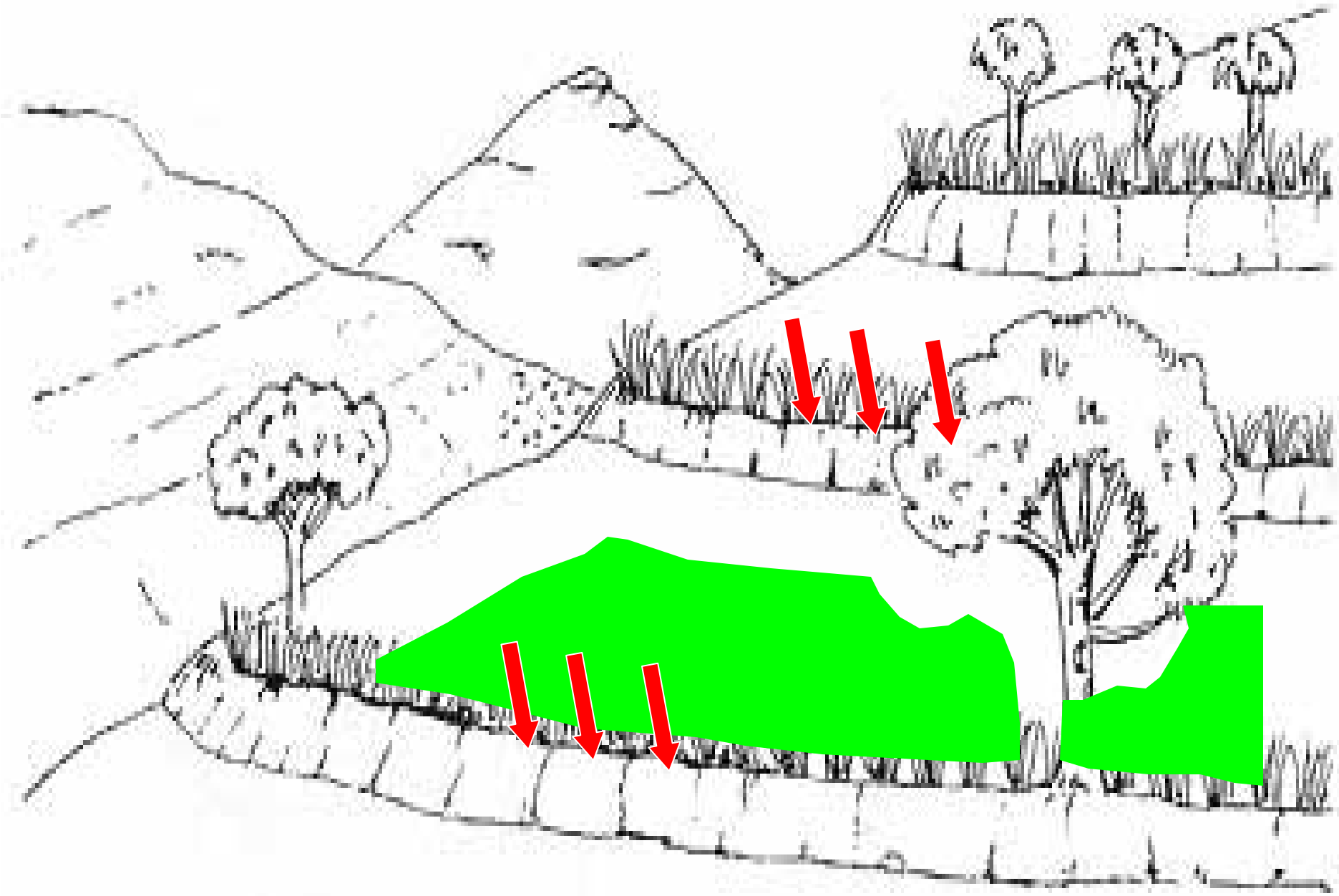
→poverty, hunger

# *Solutions*

- **include smallholders in water & land management planning (equitable distribution)**
- ***upscale*** **Soil & Water Conservation programs to allow *sustainable* (intensification of) agriculture**


Solutions I: on slopes
Vetiver's capacity to reduce erosion and improve soil texture – trapped top soil 40cm in 30 months
On-farm: hedges against erosion

# No competition with crops



# 2. Viet Nam: cassava

- Nippon Foundation (China, Thailand, Vietnam), '94-'03
- Dual goal: SWC and >50% income increase

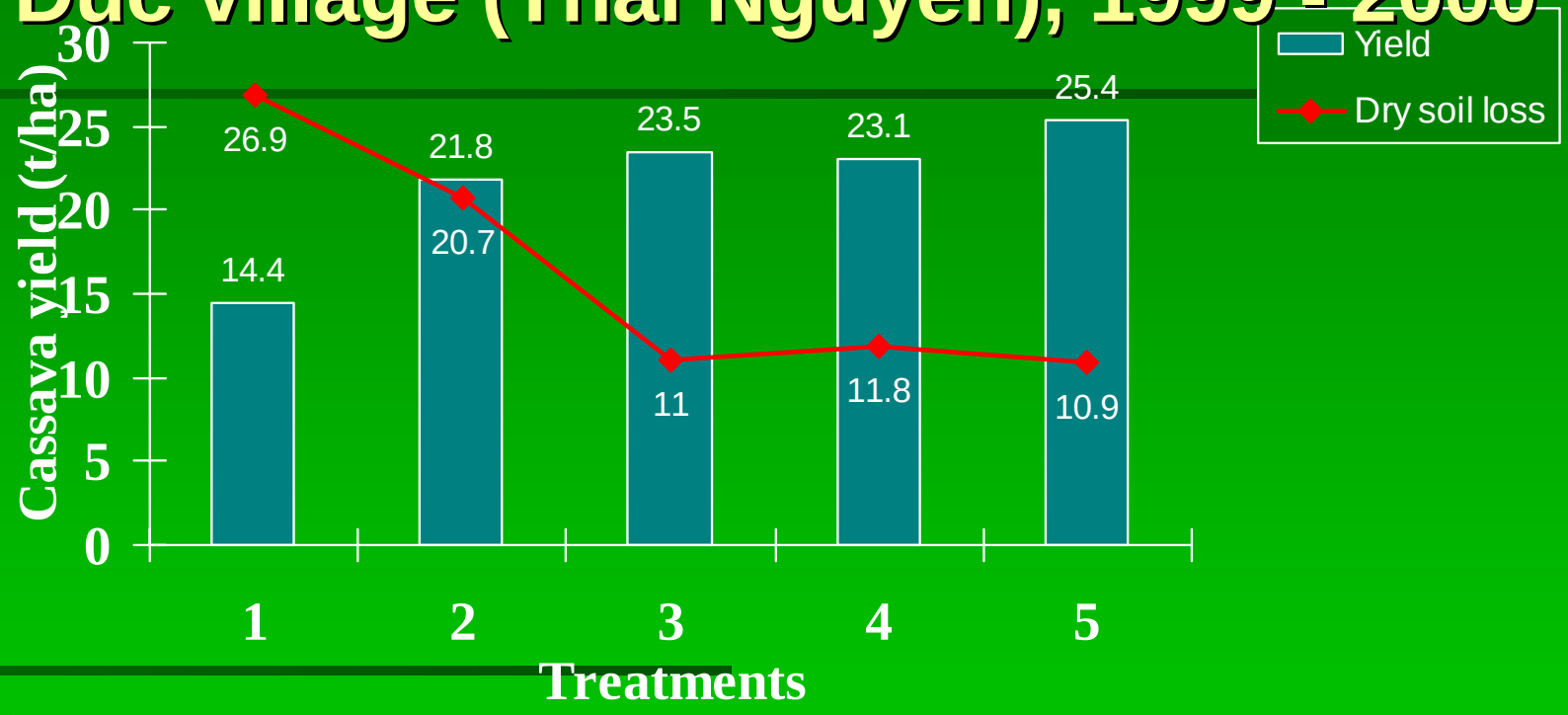
Cassava improvement package:

- Hedgerows against erosion: Vetiver, Tephrosia, etc.
- Low-branching high yielding cassava varieties
- Intercropping with peanuts or beans
- Combi FYM and/or chemical fertilizer
- Processing, marketing

*Making soil loss visible*

*and discussing long-term consequence*

# Two farmer trials on intercropping and hedgerows
# Minh Duc village (Thai Nguyen), 1999 - 2000




**Treatments:**

1. **Farmer practice (Without hedgerow)** ➔ **12 tones FYM + 45N + 30$P_2O_5$/ha**
2. **C + Teph.**
3. **C + Peanut + Vetiver (hed.)**
4. **C + Peanut + Teph. (hed.)**
5. **C + Peanut + Teph. and Vetiver (hed.)**

**10 tones FYM + 80N + 40$P_2O_5$ + 80$K_2O$/ha**

Results of Farmer Participatory Research trials, visual results, farmers assess and decide

Vetiver contour hedges (Dong Rang commune, northern Vietnam) provide in-situ mulch, stop runoff and erosion, and reduce slope by natural terrace formation

## *Results*

- soil loss reduced to half or less
- high farmer adoption rates of Vetiver *combined with other innovations* (cassava varieties, intercrop, manuring)
- cassava yield +50%: from 8 to 12 t/ha (Viet Nam) ***and*** additional peanut yield (2 rows/alley)

**→farmer benefits almost doubled**

**→farmers have seen results**

# *But…*

- +/- Researcher-managed ‘on-farm’ trials: subsidized inputs (even FYM) → farmer adoption rates bias (lead by incentive)

  *solution: direct cash incentive for any package*
- - Vetiver space not calculated in yields
- + Other advantages of Vetiver (handicraft, fodder, mulch) not explored
- + Long-term advantage not explored
- - Local nurseries: nobody trained?!!

# *Farmer adoption: factors*

- Cost-benefit of fertilizer vs. hedgerows (incl. labour)
- Financial position of farmer: labour vs fertilizer cost
- Cost-benefit alternative SWC methods (e.g. contour ridging, intercropping, stone terraces, closer spacing +fertilizer, low-branching variety)
- Land ownership facilitating long-term investment
- Scope for additional benefits (mulch, fodder, handicraft, pest control…)

# *Keys to success*

1. Making economic benefits *visible*
2. Participation: farmers to test and adjust the package
3. A **comprehensive or integrated approach**, offering a **package** of measures (incentives linked to ***package*** **-** not particular inputs***)***
4. Promoting other beneficial uses of Vetiver (fodder, handicraft, pest control)

# *Showing potential other uses of Vetiver*

*Handicraft, fodder, pest control, etc.*

17/02/2009

# *But, to extend the experience...*

Serious (local) political will required to integrate erosion control in existing research and extension programs:

- National, local policy on sustainable farming?
- Focus on maize?
- VS is knowledge-based (not input-based) → does not sell → no direct benefits for extension staff

**→ motivate farmers, community, & extension staff *based on results***

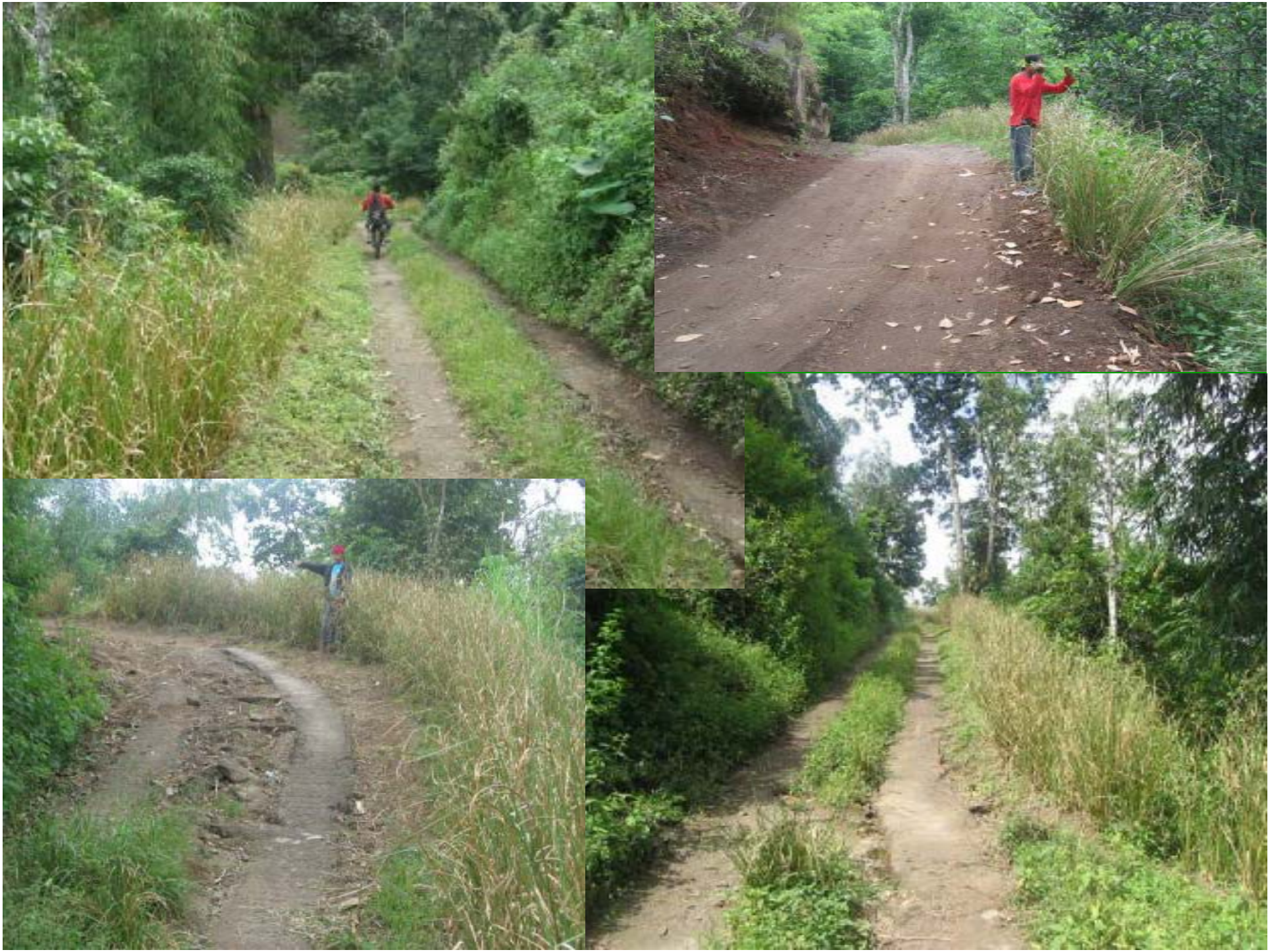
Thong Nhat commune in northern Vietnam in 2000

# Cassava ‘new style’: farmer pride

# 3. East Bali poverty project: schools & communities

The problems…

*Transport → services to reach village*

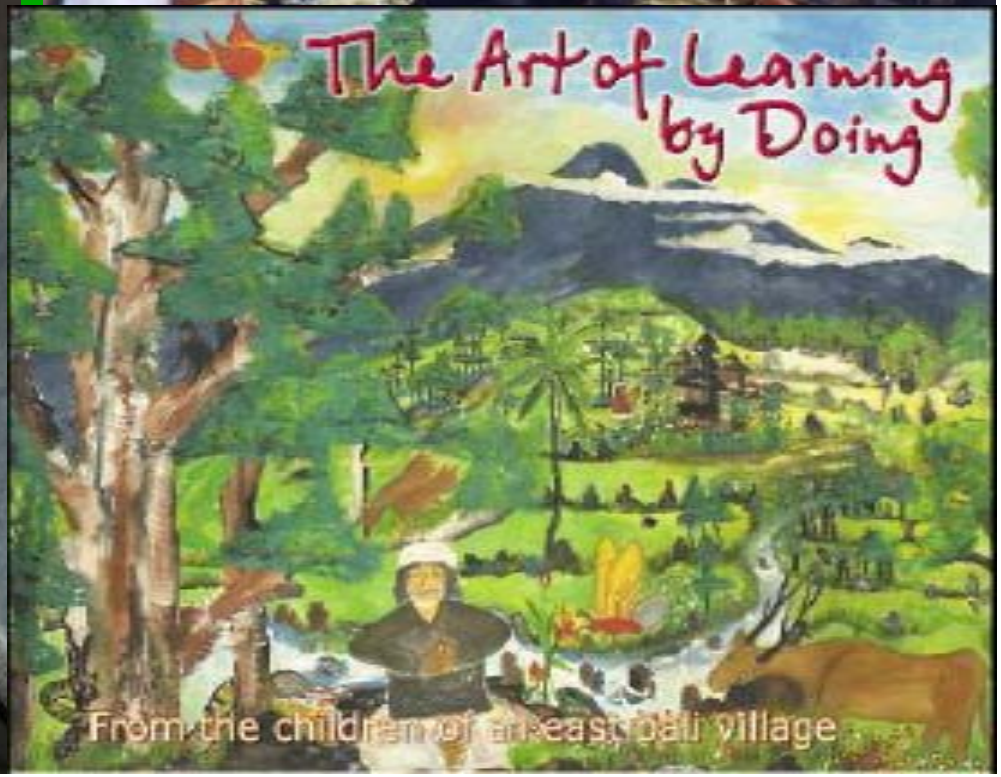


*School garden: cut terraces, bamboo shape, then Vetiver in borders*

School: roof thatch classes

Nursery: harvesting for re-planting

# Flowers from roots & leaves

**Children: “..**

- school garden location was shock: too steep & dry, rain would wash away anything planted
- surprise when being told to cut terraces & plant ‘Vetiver grass’
- agriculture teacher: “Vetiver has roots going deep, storing water below → grass would stop soil washing away

**Adults: awareness raising, signing MoU…**

**- community learning garden**
**- protecting school, houses**
**- protection of spring**

# Building protection: schools & homes

# Mountain spring protection

After 6 weeks

After 11 weeks

# *Summary results for 2500 families*

| Main Community Problems in 1998 | *Sustainable change with VETIVER* as Key |
|---|---|
| **Highway infrastructure & public transport:** ***None***! Steep, sandy, erosive mountain tracks, no vehicles above 700 m: walking is only choice for most. | **+20 km dirt roads improved** with full community participation; Vetiver protecting erosive parts: → **2,500 families linked** to markets, health facilities (monthly in hamlets) |
| **Illiteracy 75-100%** in upper regions Mt Agung & Abang (50% overall) | **> 600 children** educated since 1999 → 97 SP graduates, 80 in Junior high school |
| ***Severe*** **Malnutrition, diet inadequate:** Cassava & corn staple – no nutritious vegetables, fish or iodised salt; community unaware of diet problems | **Nutritious org. vegetables in schools**, community & kitchen gardens – link to market Malnutrition almost eliminated. |
| **Child mortality <1y old: 25%** (EBPP survey 2000-2001) – key causes: weak at birth, micronutrient deficiencies, polluted water | **Child Mortality 0-5y: 0.0007% !** Micronutrients provided ; Sanitation education → all use clean water, hygiene |
| **Iodine Deficiency Disorders (IDD) children 6-12y: 84.5%** (Govt. health survey, 1998) | **Only 20% have IDD** (Govt. survey 8/2005): much lower than national average |
| **Water supply**: ***None****! 2-3h* walk to mountain springs, many polluted; most use home rainwater storage with high E-coli bacteria | **+ 1,300 hh have safe piped spring water**; +300 hh rainwater reservoirs protected; water education |
| **No Local Health facilities:** 85% never saw doctor, very few babies born with midwife help, most kids never vaccinated – due to lack of roads, transport. | **Health facilities for all 2,500 families** – in 2003 EBPP initiated 21 monthly hamlet hamlet-based health posts |

# 4. Malawi: maize


Vetiver on a contour in Malawi

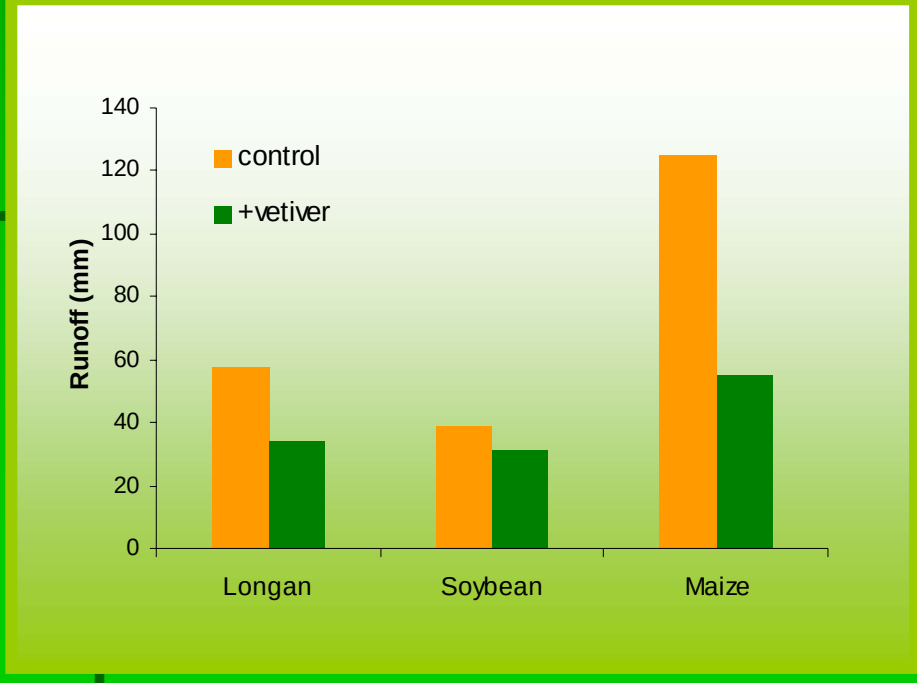
Vetiver on contour in Malawi 2007

# 5. In plains: flood damage control

**Solution: on-farm flood protection**

**Sorghum in Australia: preventing damage of young plants, trapping silt, increasing infiltration**

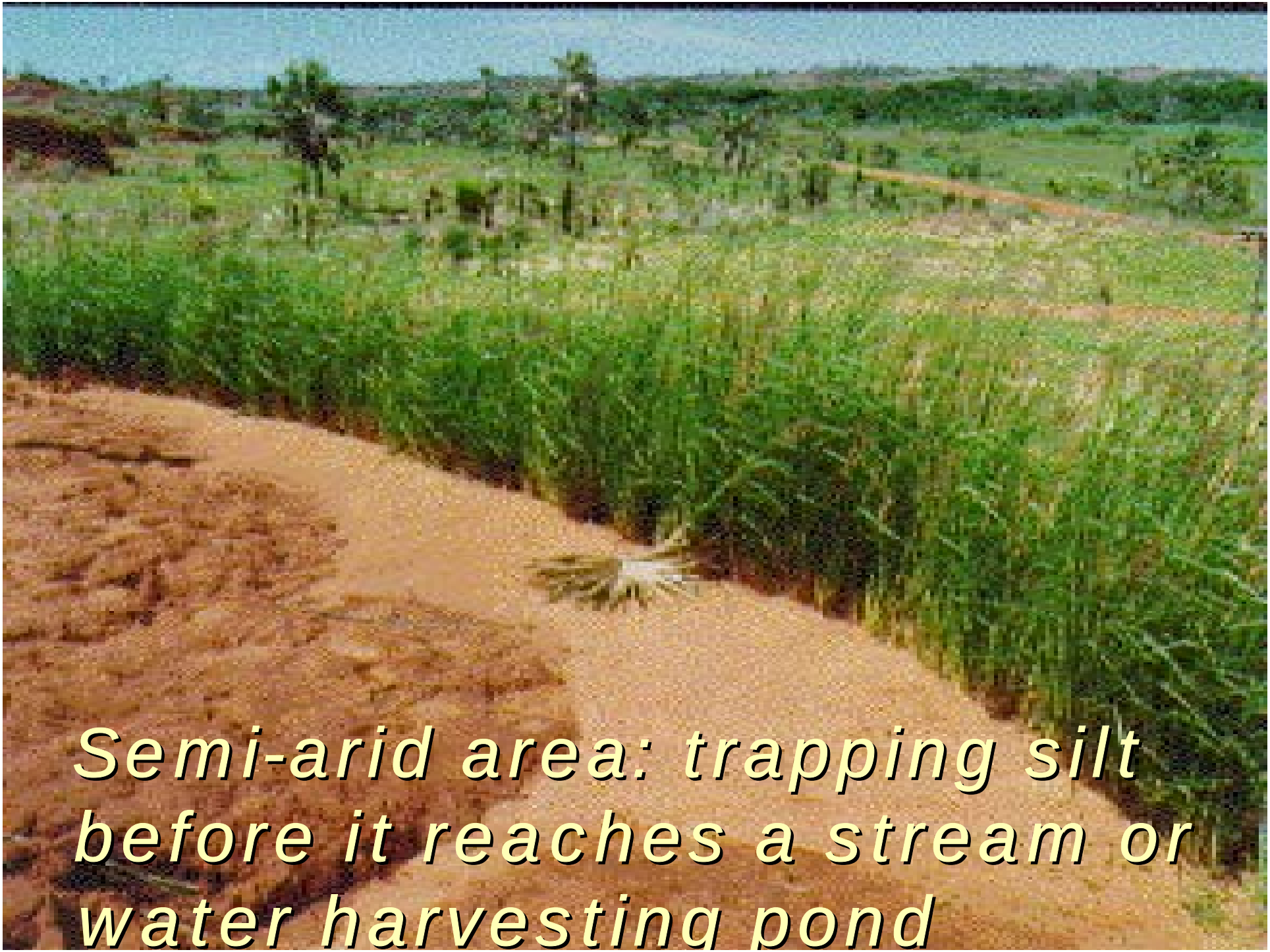
# 6. In semi-arid areas




**Hedgerows across slope, on loamy soils (low soil hydraulic conductivity & high runoff):**

**- runoff reduced by 19-56% - groundwater recharge increased up to 20 %**

# Maize farm in Ghana


Semi-arid area: trapping silt before it reaches a stream or water harvesting pond

*Soil rehab: making mulch in Burkina Faso*


Holding back wind erosion in Senegal

# Windbreak in Dakhla (betw. Senegal & Mauritania)


Problem site in Senegal:
vegetable growing in brackish (dune) sand

# 6. Other uses: fodder, pest control, handicraft



‘roadside’ grazing, zero-grazing, for all ruminants

# *Semi-arid area: SWC-fodder combi*

- Cutting regularly (every 4-6 weeks) assures higher protein, digestible forage
- 10 tons/ha in fairly dry part of India (500-600 mm rainfall): equals ±100 kg dry leaf / 100 meter hedge
- As with other tropical grass for fodder: adding leguminous fodder required to increase protein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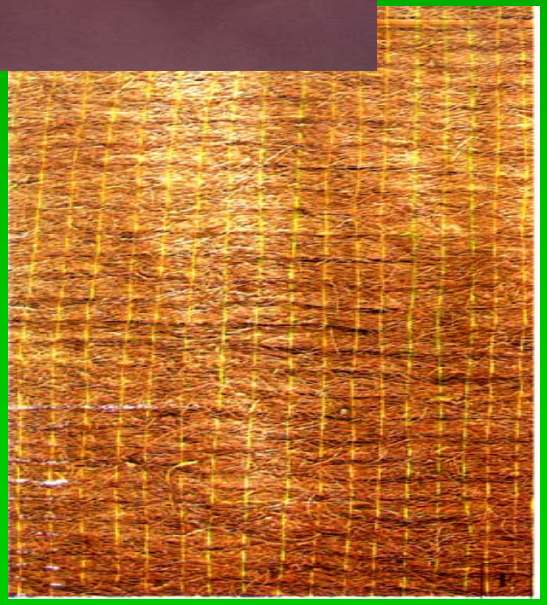
## Handicrafts

From shoots



## From roots for insect repellant use

Vetiver Network Kenya

letwork

# Construction materials


Vetiver clay tiles

## Cement replacement material

Low-cost, environmental-friendly, energy-saving construction material can be made from vetiver grass ash as a mortar

especially for the rural areas


Rice storage silo

# Stem borers of maize and sorghum

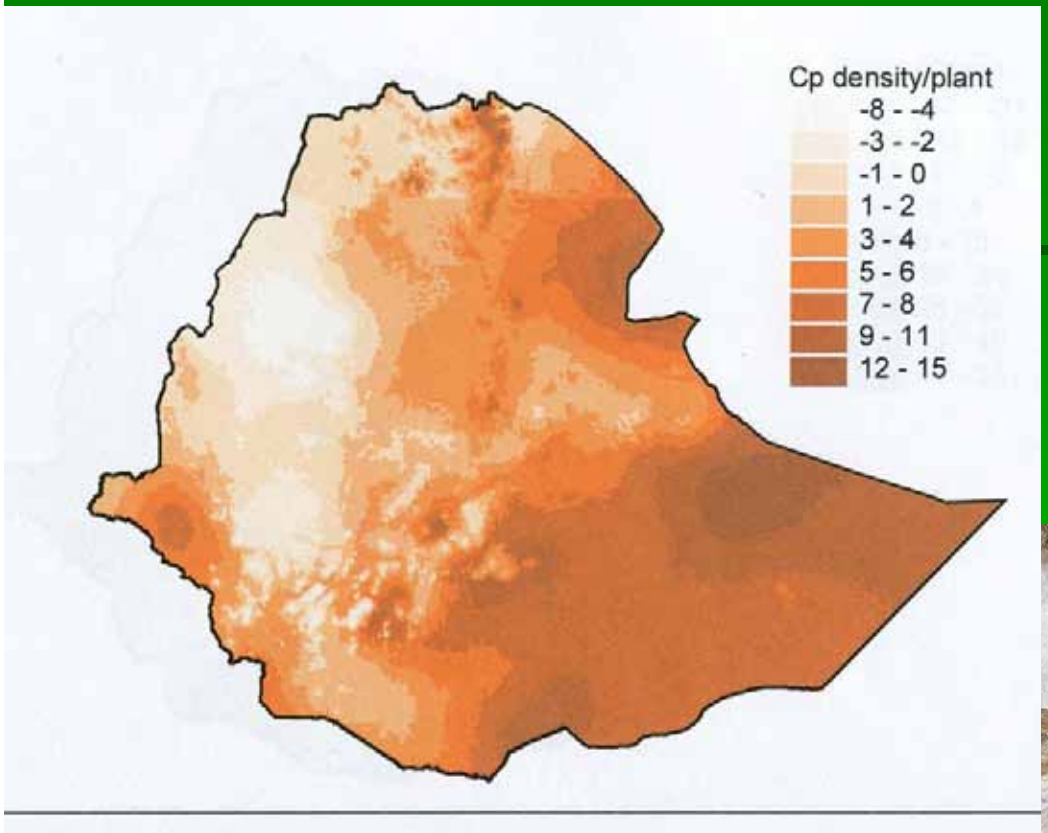



Figure 7.1: Predicted distribution of *Chilo partellus* in Ethiopia using density per plant

(Emana Getu Degaga, 2001)

**NB: not Busseola**

# Life cycle of stem borers

Moth

Eggs

Larvae

Pupae

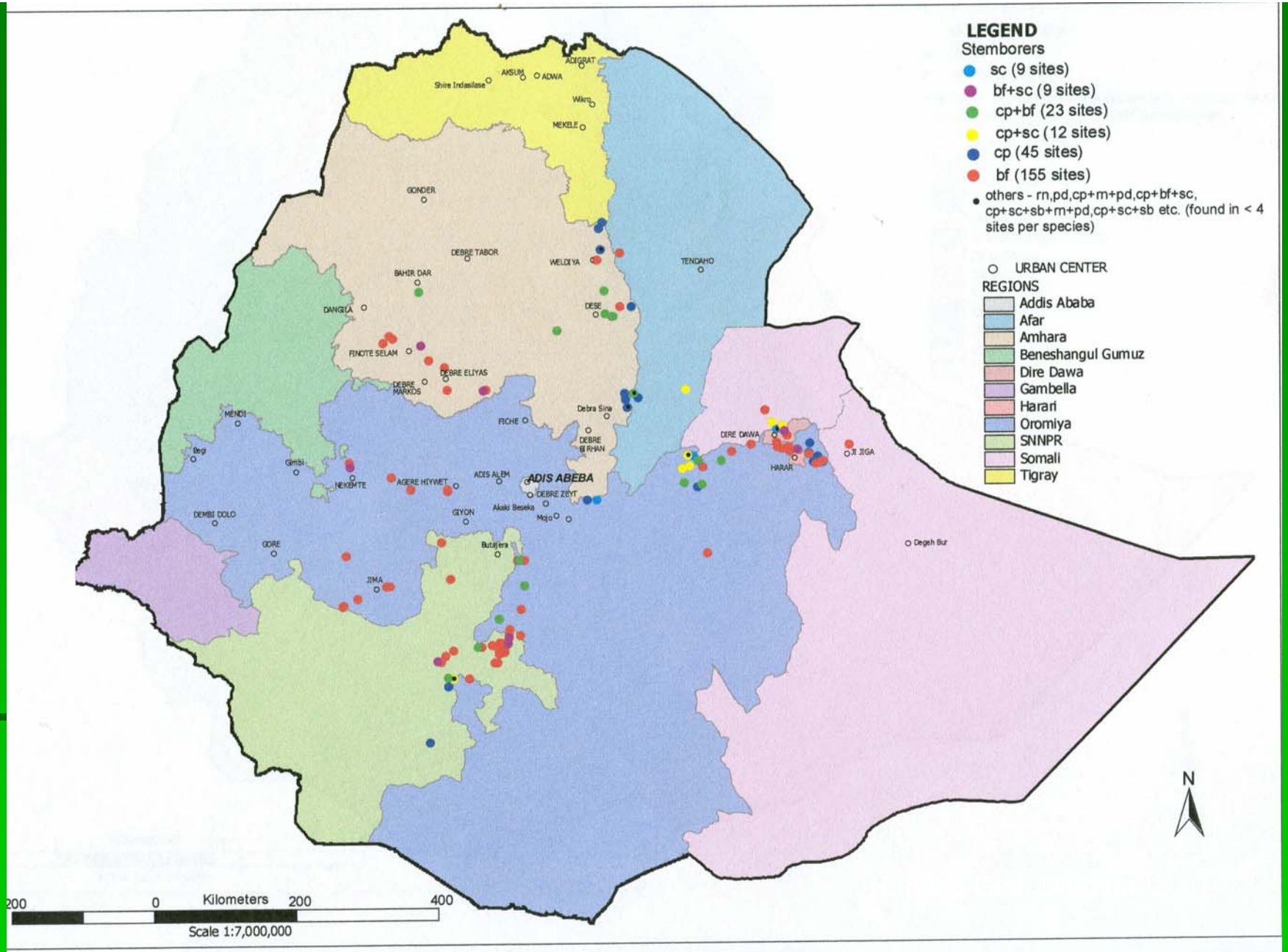
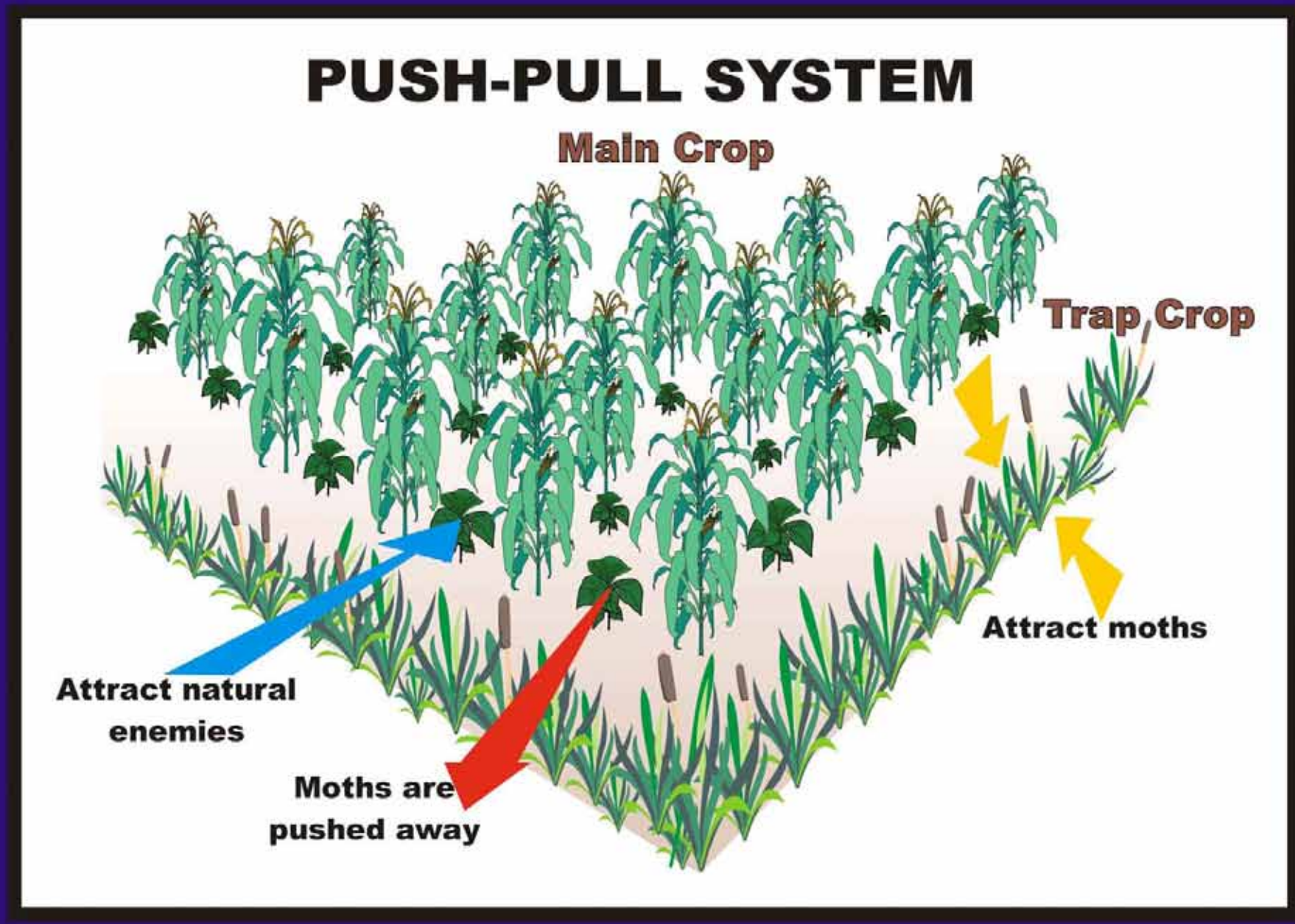
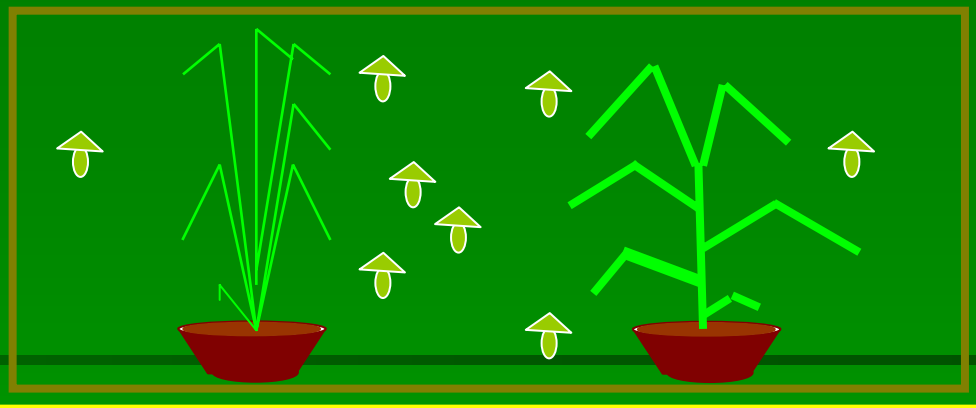


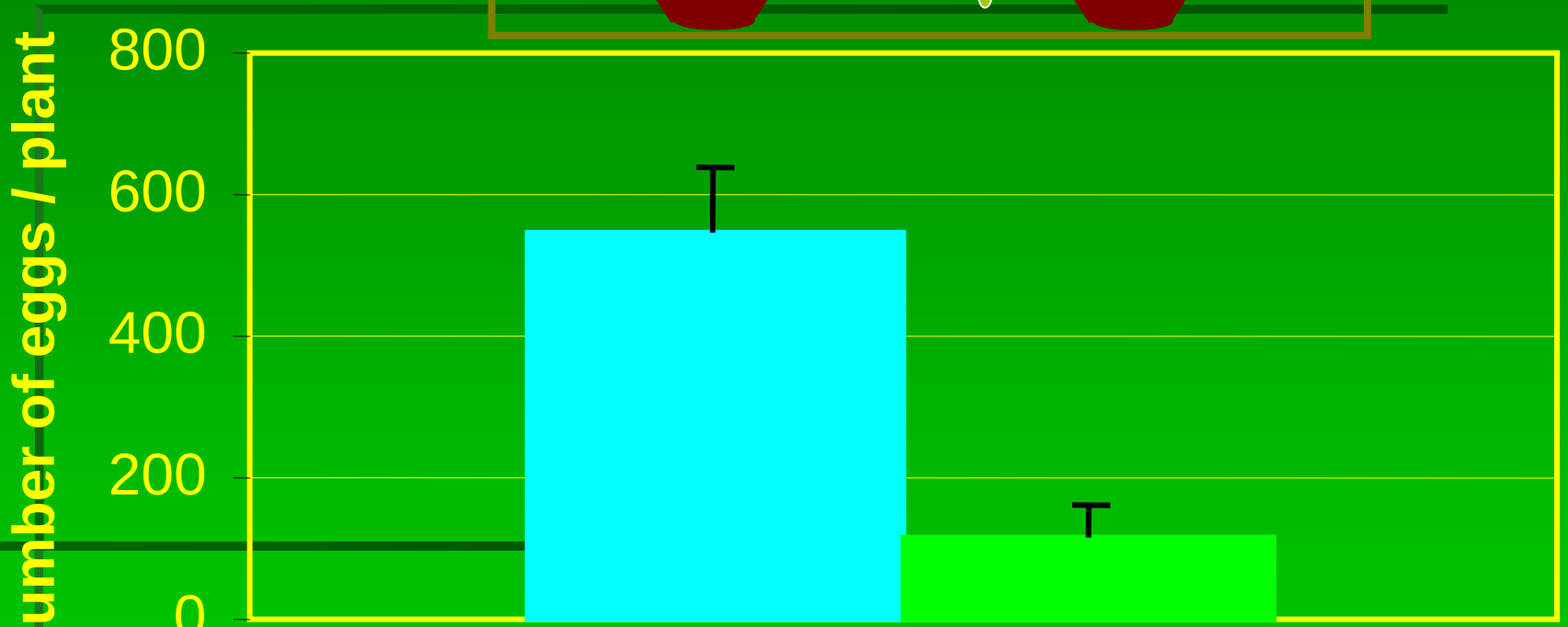

Figure 4.1: Stem borers Distribution in Ethiopia in 1999

**Excellent research in Ethiopia over the past 3 decades**

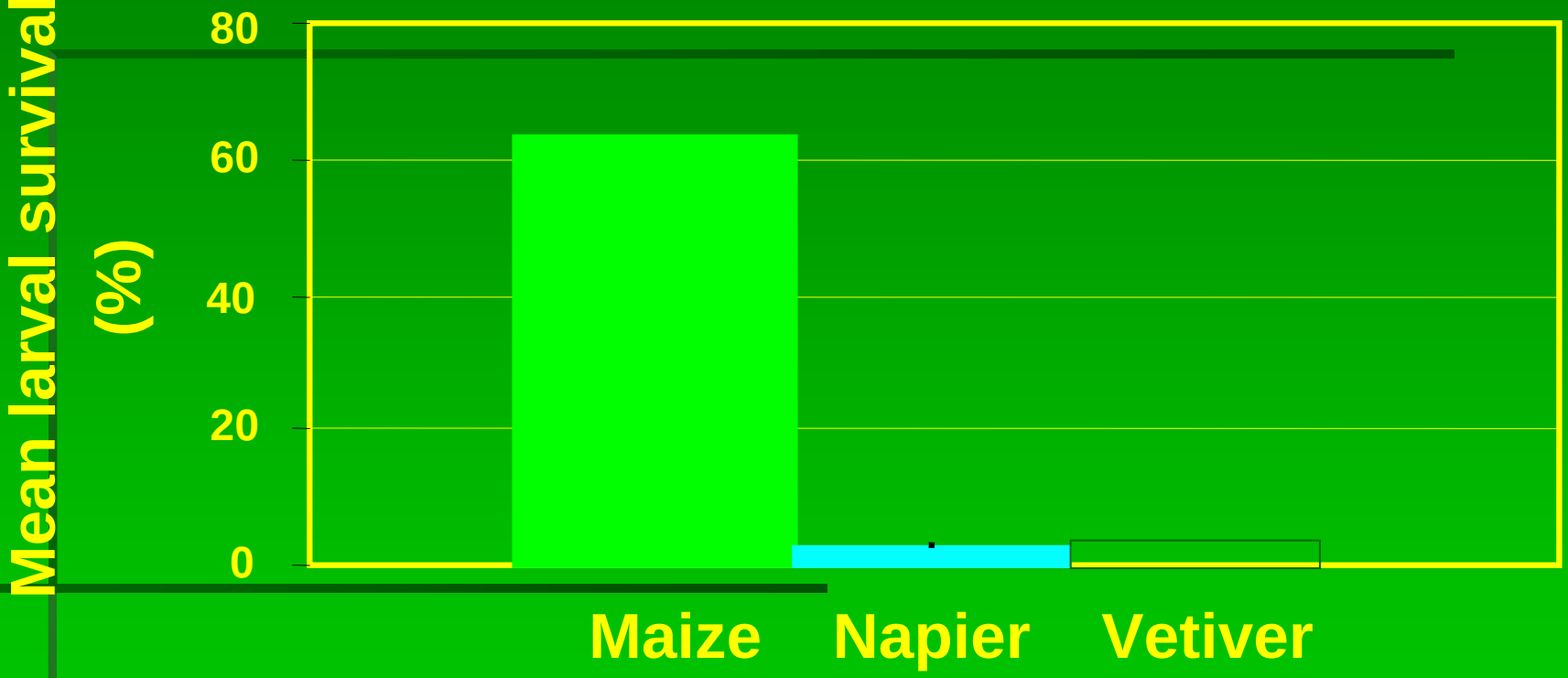
# Habitat management system





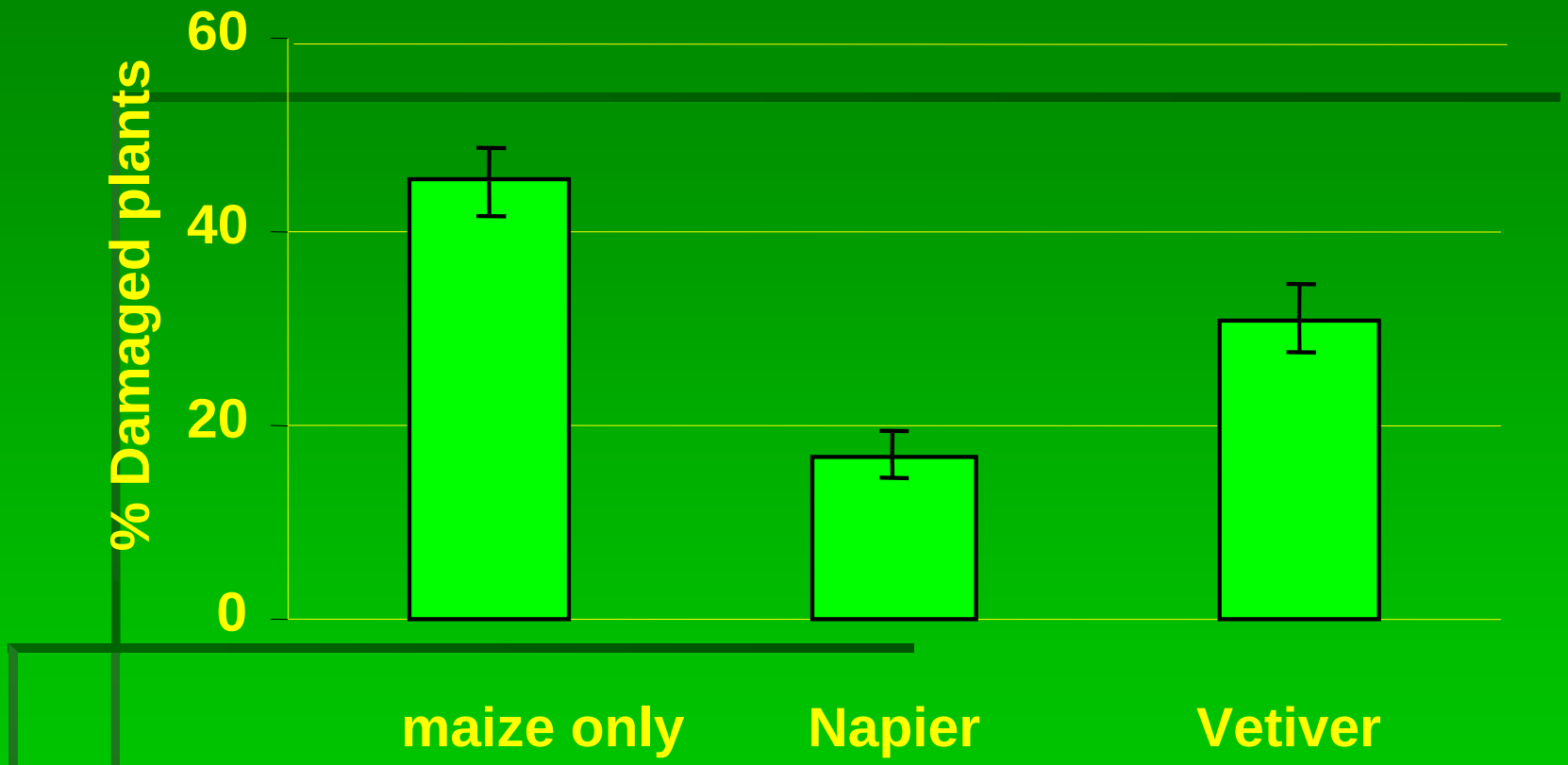



**Number of eggs per plant laid by *Chilo* moths in 2-choice tests in cages**




**Survival of *Chilo partellus* larvae after 28 days on potted plants in a green house experiment.**

# Field studies in South Africa & Malawi:
## Napier grass, Vetiver, maize mono-crop



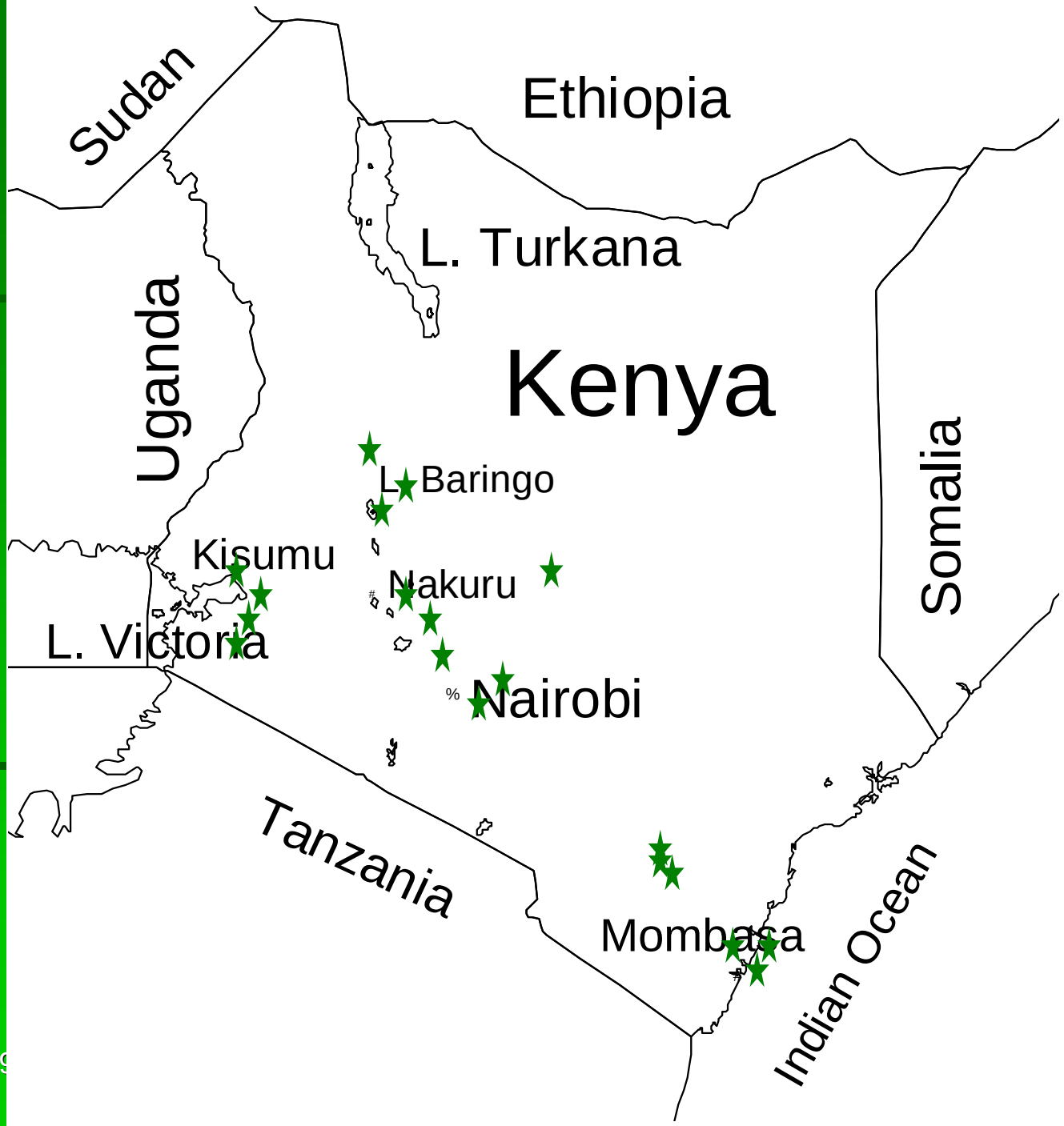

Damaged plants (%) in maize mono-crop and blocks surrounded by Napier or Vetiver grass

# CONCLUSIONS

- **Vetiver grass exhibited all the characteristics of an ideal trap crop for *Chilo partellus***
- **More field evaluations needed**

# 5. Future perspectives in Kenya

- Extending the professional network (to existing professional organisations: GO, NGO, companies, international)
- **Demonstrations in semi-arid areas: water harvesting, infiltration, SWC**
- Demonstrations of applications new in Kenya:
  **phyto-remediation, protection of infrastructure** e.g. roads, railways, riverbanks
- **Advocate for innovating government policies & practices in Ministries of Transport, Agriculture, Environment, etc.**


Sudan
Ethiopia
L. Turkana
Uganda
Kenya
Somalia
L. Baringo
Kisumu
Nakuru
L. Victoria
Nairobi
Tanzania
Mombasa
Indian Ocean

# *W.Pokot: Wei wei farmers' irrigation project*

Vetiver is planted on edges of plots, along water-courses, gullies and traditional irrigation furrows

# *ICRAF, KARI also have this in mind*

**ICRAF scientists & KARI about L. Victoria basin:**

- unsustainable farming practices → large areas of degraded, abandoned land **where soil needs rehabilitation**
- small-scale farmers forced to change practice, this includes: **providing knowledge of alternatives on SWC** (win-win: improve short-term yield and long-term sustainability)
- multi-disciplinary solutions on landscape level (Lou Verchot); **address farming, water infiltration/storage, flood protection, prevention of landslides and gullies**

## *T Katuk–Odeyo gully: 25 m depth, for >45 km*

Kikwit ravine near Kinshasa:

Right: start of work;

Left: shaping;

Left below: sticks of trees to plug gully

Below: after 2 months


*Vetiver Systems, as part of the solution, can be part of your plans ?!*

*Yes we can !*