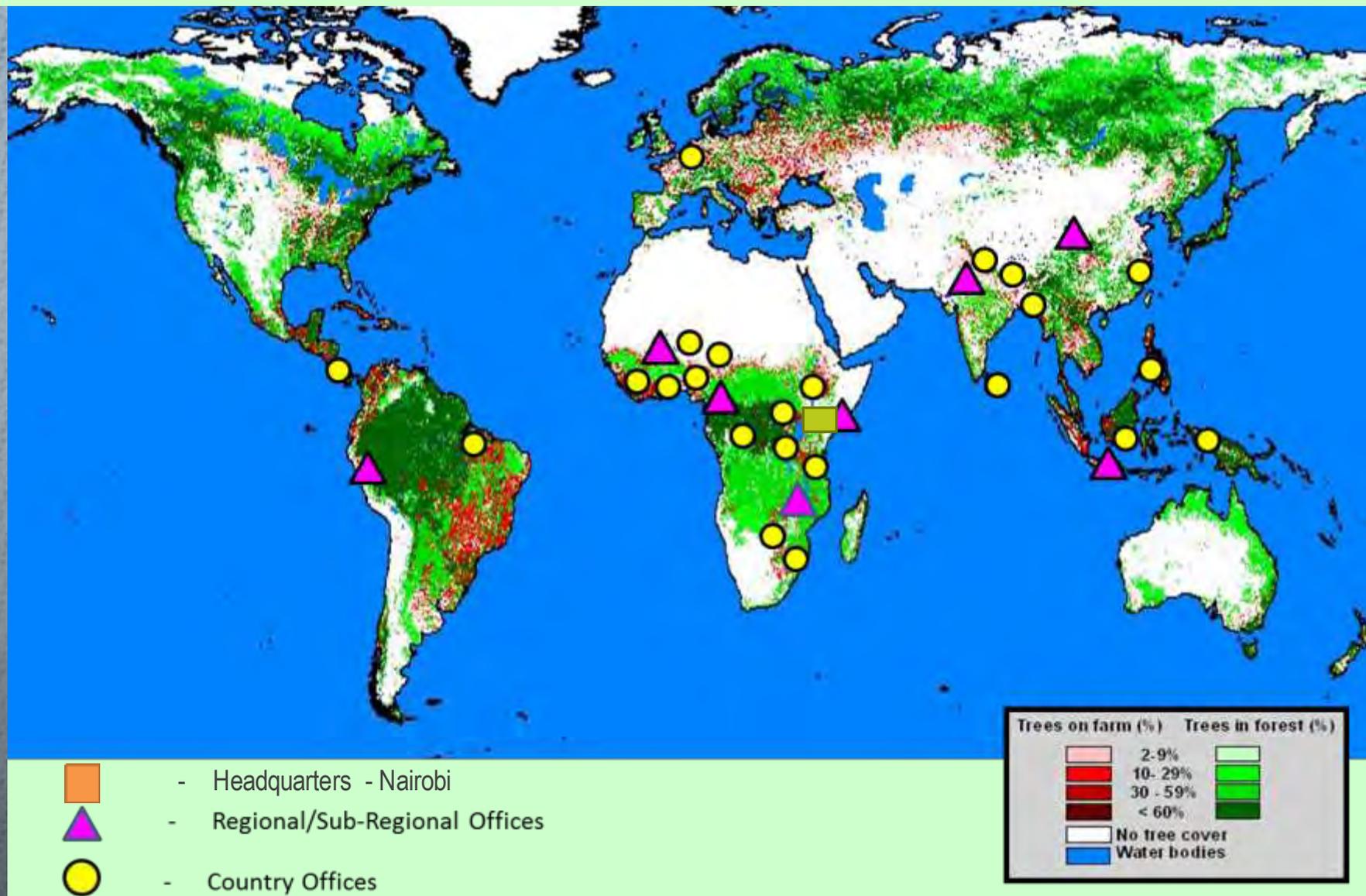


# Temperate Fruit Trees Agroforestry Systems in the Tropics with focus on the Eastern African Highlands



Presented at the Echo East Africa Symposium in Arusha, Tanzania.  
3 – 5 February, 2015

# Global, Regional & National Spread of the World Agroforestry Centre (ICRAF)



## ICRAF Science Domains (SDs)

SD1 – Agroforestry Systems

SD2 – Tree Products and Markets

SD3 – Tree Diversity, Domestication & Delivery

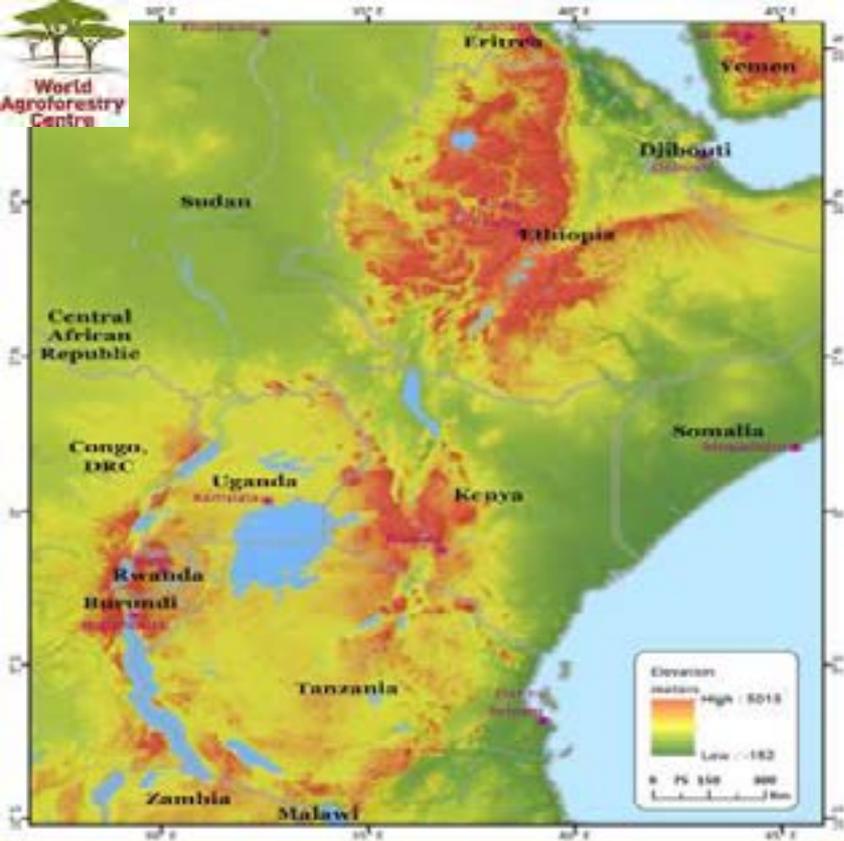
SD4 – Land Health

SD5 – Environmental Services

SD6 – Climate Change

# Presentation Outline

- o Background to the EA Highlands
- o Why should you consume fruits?
- o Common temperate fruit trees in EA highlands & their attributes
- o Fruit trees agroforestry
- o Fruit trees production challenges
- o Opportunities
- o Key messages

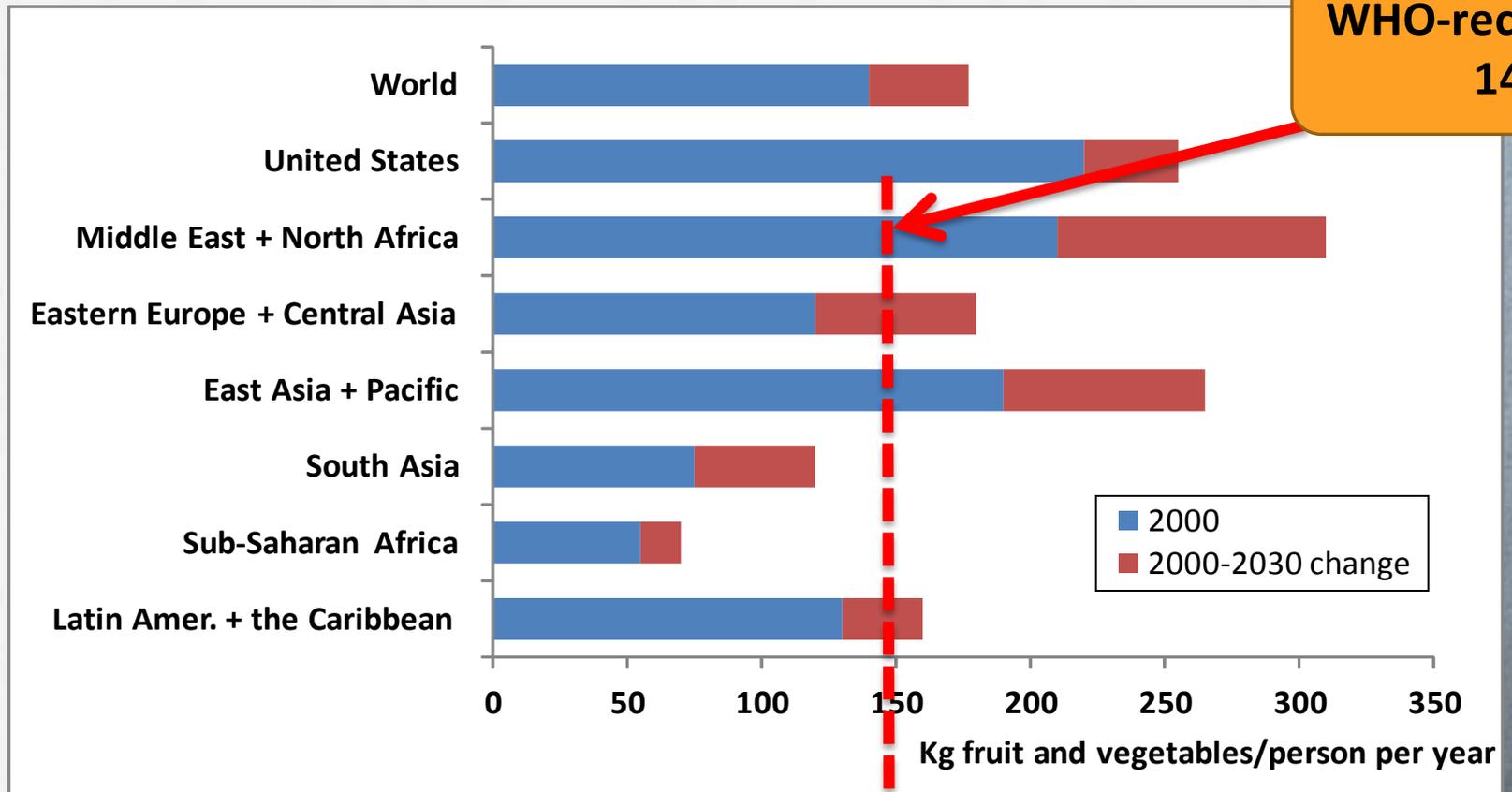


## Highlands in Eastern Africa (Ethiopia, Rwanda, Burundi, Kenya, Tanzania, Uganda)

- Areas > 1,500 m.a.s.l.
- Mean daily temperature of 20°C (Exhibits temperate climatic conditions)
- Total highland area 806,500km<sup>2</sup>
- Population in highlands range from 16% in Uganda to 96.2 % in Rwanda
- Highest highland population (> 80%) in Eth, Ke, Rwa and Bu

# Why consume fruits

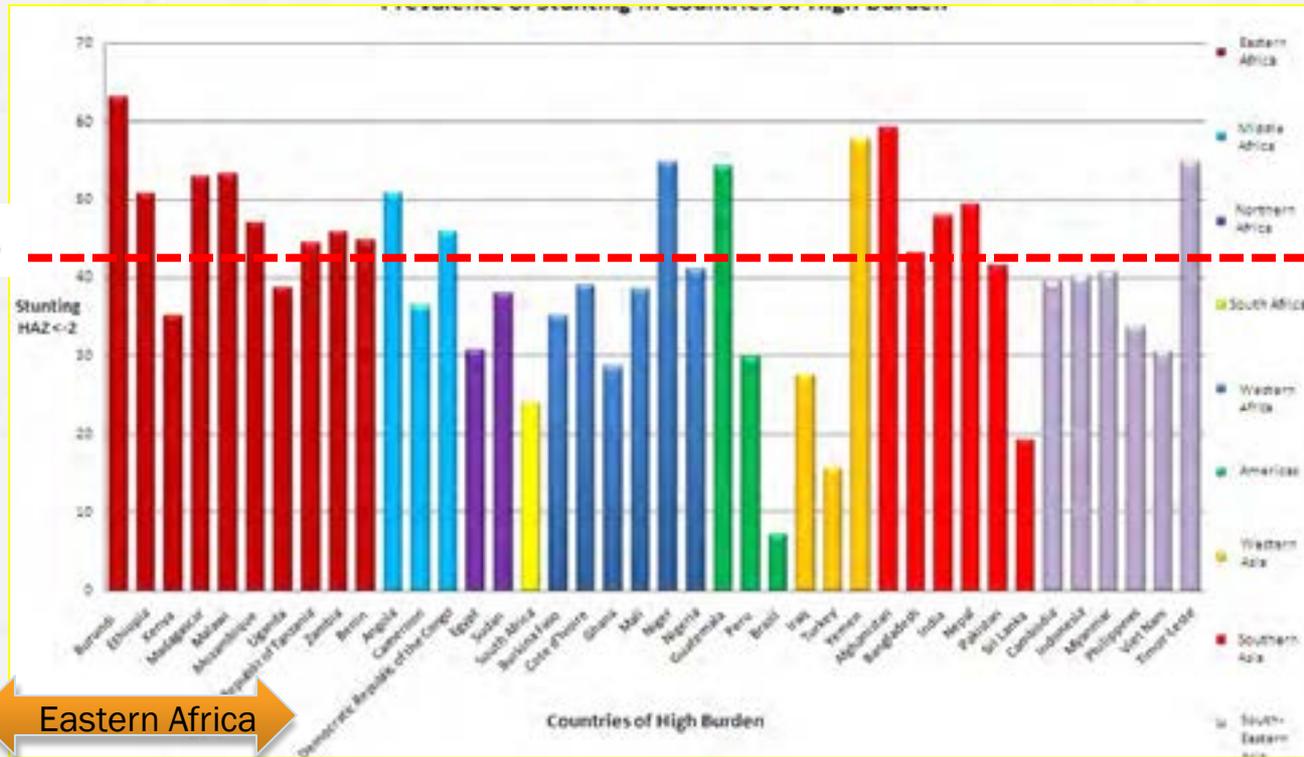
## Past and projected fruit and vegetable consumption globally 2000 – 2030



Example: Uganda: 64 kg fruit + vegetables

# Prevalence of stunting in selected countries

40%



Eastern Africa

Countries of High Burden

# Business Daily (Kenya) Jan 27, 2015

- ❑ Malnutrition affects 9 out of 10 people in Kenya
- ❑ Levels of malnutrition rising, driven by the near absence of fruit and vegetables in many Kenyan diets
- ❑ Emphasis on staple foods (ugali (maize meal), rice, etc)
  - Micronutrient deficiencies
  - Stunting growth and intelligence
  - Suppress immune systems
  - Cause of multiple diseases and deaths

The cultivation of temperate fruits in tropical regions can easily address the nutritional imbalance

This is often neglected / overlooked



# Common temperate fruit trees in the eastern African highlands

- o Apple
- o Pear
- o Plum
- o Peach



# Calories & Nutrients content per 100 g edible part of various temperate fruits



Fruits	Water (%)	Calories	Proteins	Carbohydrate s	Fats
Apple	55	54	0.2	12	0
Pear	87	55	0.5	8	0
Plum	89	48	0.5	15	0
Peach	90	41	0.8	13	0
Avocado	74	221	0.6 - 4.4	10 - 12	5 - 32



# Average Daily Minerals and Vitamin Requirement for Healthy People



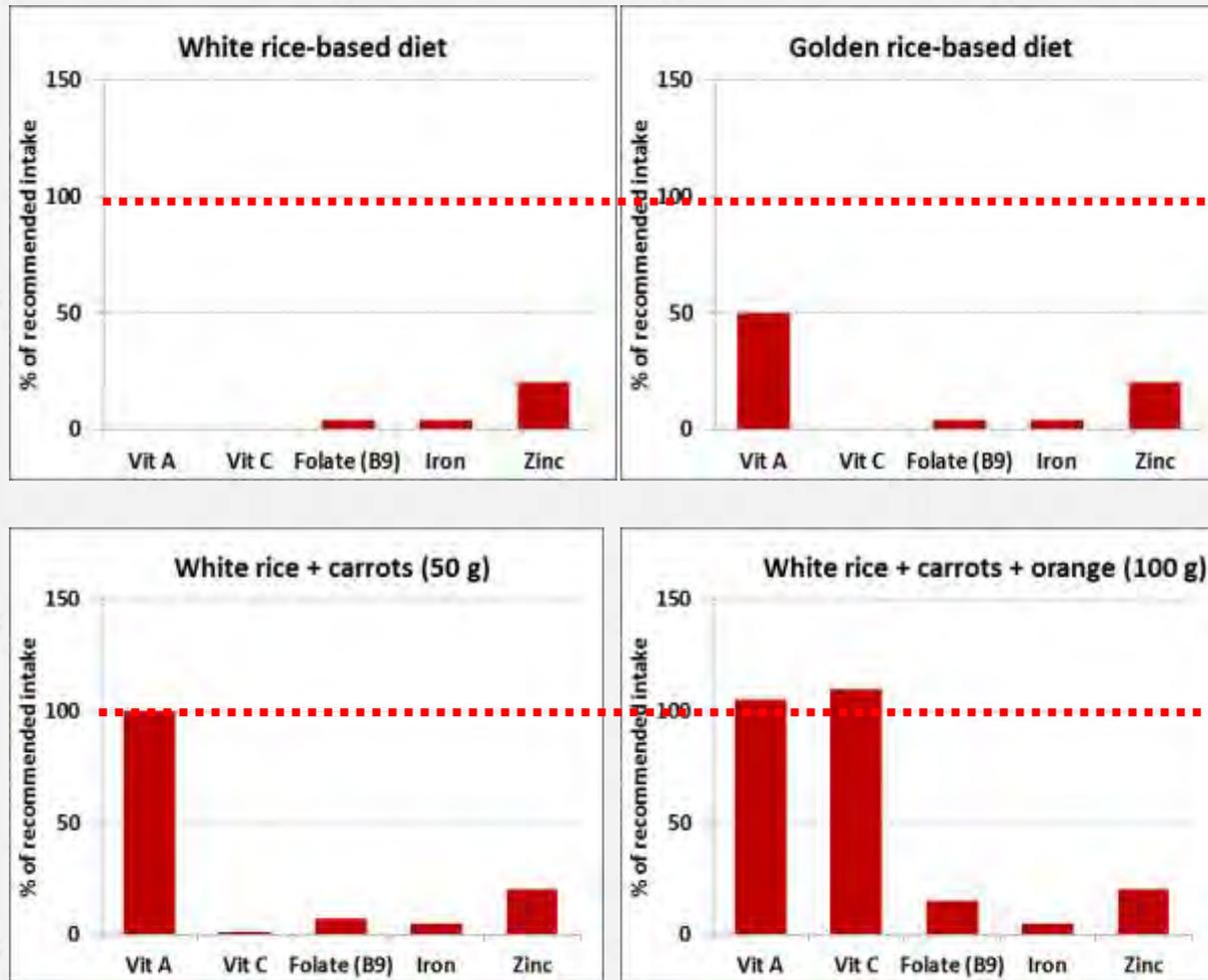
<b>MINERALS</b>	<b>Calcium</b>	<b>Potassium</b>	<b>Magnesium</b>	<b>Phosphorus</b>
	800	3000 - 4000	300 - 350	800
<b>VITAMINS</b>	<b>B1</b>	<b>B2</b>	<b>C</b>	<b>Niacin</b>
	12	16	76	15 - 18



## Minerals content per 100 g edible part of various temperate fruits

<b>Fruits</b>	<b>Calcium</b>	<b>Potassium</b>	<b>Magnesium</b>	<b>Phosphorus</b>
Apple	7	144	6	12
Pear	10	125	8	15
Plum	14	221	10	18
Peach	8	205	9	23

# Rice versus fruits & vegetables: Minerals & vitamins contents



Derived from WHO/FAO 2004: "Vitamin and mineral requirements in human nutrition"

- Temperate fruits fetch **high market price** in the tropics due to a few tropical belts where they can satisfactorily be grown
- Provide an easily available source of **micronutrients**
- **High species diversity; therefore** harvest of different fruits possible year-round → filling the 'hunger gap' before harvest of staples
- High potential for **income generation** from sales of fresh and processed fruits, particularly for women
- Fruit trees **more tolerant to droughts than annual crops** → food security, resilience, climate change adaptation

# Fruit Trees Agroforestry



# Agroforestry defined



Derived from *Agriculture & Forestry*

*Simply put:*

The growing and managing of trees on farm for economic and ecological benefits.

***The inclusion of trees in farming systems and their management in rural landscapes to enhance productivity, profitability, diversity and ecosystem sustainability***

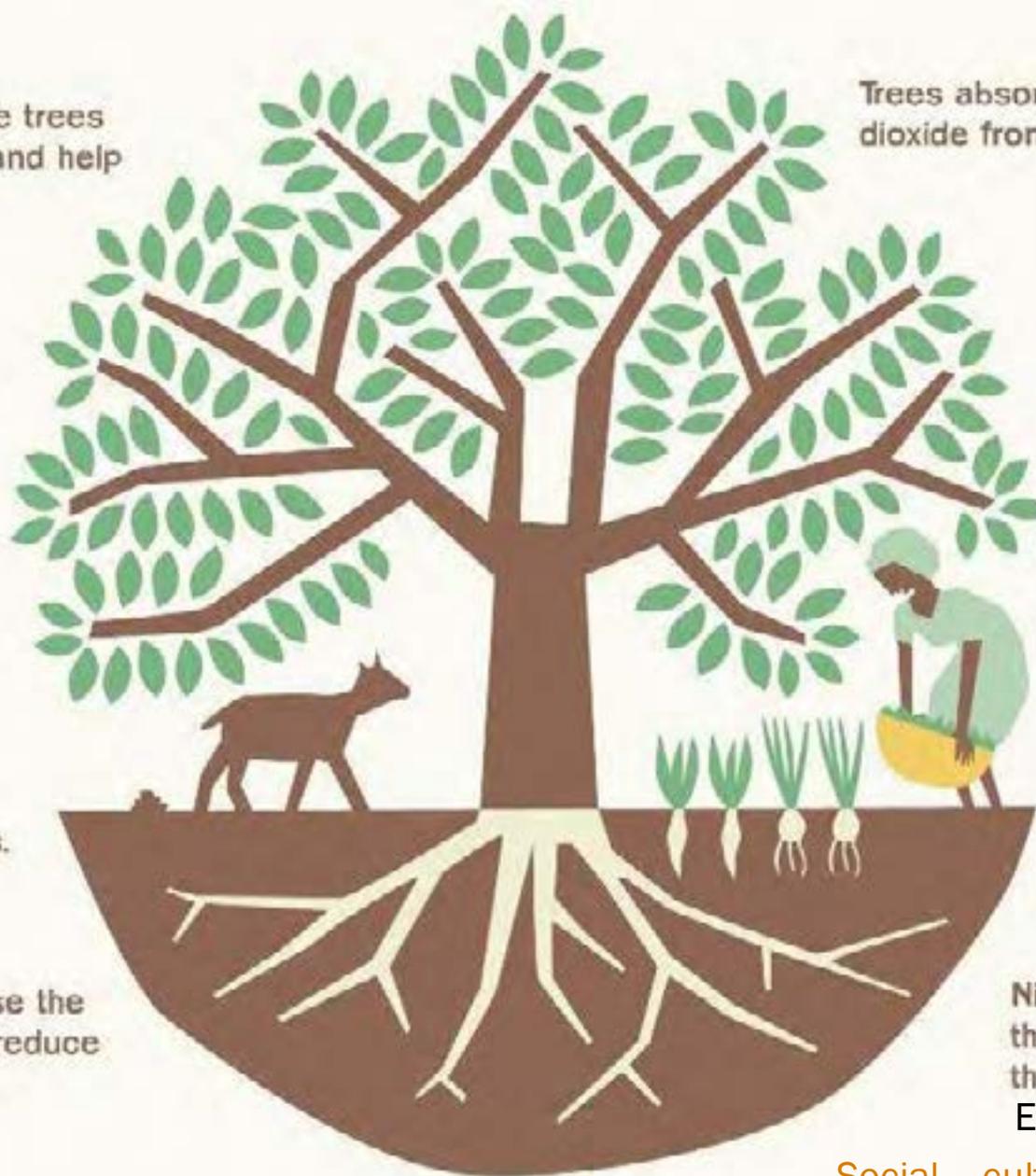
Leaves from the trees enrich the soil and help keep it moist.

Increase the population of pollinators

Trees provide fodder for the animals.

Manure from animals is used for crops and trees.

Trees stabilise the ground and reduce soil erosion.



Trees absorb carbon dioxide from the air.

Trees provide firewood, timber and sometimes have medicinal properties.

The farmer gets milk, fruit and other food from his farm.

Nitrogen fixed by the trees benefits the crops.

Eg Tamarind

Rainwater Infiltration,  
Nutrient recycling, shade

Social – cultural importance:  
Boundary markers,  
traditional warship sites,

## Suitability of different temperate fruit trees under agroforestry systems

- ❖ Fruit trees agroforestry allows intensification; an important aspect in the highlands given the small land parcels
- ❖ Fruits trees take time to close up the canopy. When the trees are young crops like beans can be grown in- between the rows
- ❖ Peach, plum & apple are deciduous (lose leaves during winter or at end of harvesting period)
- ❖ Hence can be grown with other crops especially those tolerating cool temperatures in winter.
- ❖ Fruit trees can provide shade or wind break to other crops if grown in a relay or in boundaries.

## Production challenges of temperate fruit trees in the tropics

- Insufficient chilling causes poor bud-break necessary for new shoot developments (need to breed var. for tropical conditions)
- High humidity in some locations promote fungal disease spread

# Other common challenges

- Poor agronomic practices
- Limited availability of quality germplasm
- Pests and diseases
- High levels of post harvest losses (storage, transport)
- Limited value addition
- Poor market infrastructure
- Policy factors dis-favoring fruit production (fruits production not a priority → emphasis on staples)
- Limited consumption (limited market pull effect)

# Crop husbandry

Temperate fruit trees require

- ◆ Well drained, fertile soils
- ◆ Adequate moisture (irrigate and mulch the trees)
- ◆ Gentle slope along the ridge sides
- ◆ Good tree spacing and weed-free
- ◆ Provide windbreak where there are strong winds
- ◆ Apply fertilizer to boost productivity
- ◆ Recommended fertilizer should be based on soil/leaf analysis
- ◆ Common fertilizers: NPK, CAN, SA. TSP, DAP etc.

# Crop husbandry

- ◆ Prune trees to improve fruit size and quality (This also rejuvenates trees)
- ◆ Crop protection  
Cultural, mechanical, biological control can be used to control pests and diseases
- ◆ Fruit thinning (Improves fruit size and quality)
- ◆ Proper harvesting, grading, packing are needed (better market price)
- ◆ Storage – avoid exposing to high temperatures as they easily deteriorate

# Propagation

- ❑ The commonest technique of propagating apple, peach and plum is either budding or grafting.

## Advantages

- Enables fruiting precocity (**the age of the tree when it will first start to bear *fruit***)
- Uniform fruit yield
- Disease/pest resistance
- Dwarf tree – makes easy to harvest fruits
- This may depend on **rootstocks** as some are vigorous

# Common pests & diseases of Temperate fruit trees in the tropics



## Pests

- **Aphids** (sucks leaves, young shoots, flowers and fruits)
- **Thrips** (As for Aphids)
- **Spider mites** (puncture & destroy leaves)
- **Fruit flies** (puncture ripening fruits leading to rotting)
- **Beetles, caterpillars, grasshoppers**
- **Lichens**
- **Parasitic plants**

# Common pests & diseases of Temperate fruit trees in the tropics

## Diseases

- Alternaria leaf spot
- Blotch
- Bitter or apple canker

High humidity promotes spread of fungal and bacterial diseases and the proliferation of lichens and parasitic plants



## Post harvest losses

- 40 % of food produced in developing countries lost / wasted at post harvest and processing levels
- Globally 30 – 40 % post harvest food losses / waste
- Figures are higher for the easily perishable horticultural crops like **fruits and vegetables**

# Opportunities

- ❑ Potential for increase in demand triggered by:
  - ◆ Increasing levels of poor health due to poor nutrition
  - ◆ Role of fruits in addressing the nutritional imbalance
  - ◆ Increasing awareness in the importance of fruits in diets
  - ◆ Growing middle income group
- ❑ Agribusiness mindsets (Fruits are high value crops)

# Enhancing consumption of fruits

- o Awareness creation, campaigns, education etc. using different media
- o Promote fruit growing s a viable agro enterprise
- o Work on the value chain (fruit value chain (from production to consumption and address barriers in the different links of the chain)
- o Minimize post harvest waste

# What about conservation agriculture with trees (including fruit trees)



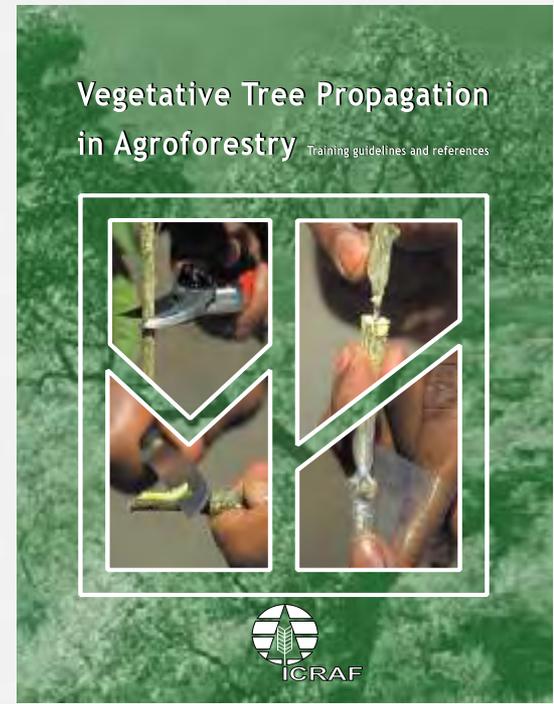
## CA principles

- Minimum or zero tillage
- Adequate soil cover
- Crop rotation / diversification (especially with leguminous species)

# Key messages

## FRUIT TREES FOR:

- o Health (An apple a day keeps the doctor away)
- o Ecosystem benefits
- o Niche markets for fruits
- o Food, nutritional and income security



# THANKS



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