Bioenergy Environmental Impact Analysis (BIAS):

First Elements of the BIAS Analytical Framework

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Environmental Issues of Bioenergy

- **Bioenergy could have positive impacts:**
  - GHG reduction (through fossil-fuel substition);
  - more **agrobiodiversity**; soil carbon increase, less erosion …
- **But impacts could also be negative:**
  - GHG from cultivation, soil carbon, life-cycle, direct + indirect land-use changes
  - **Loss of biodiversity** from land-use changes, water use, agrochemicals, erosion…

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BIAS: Brief Overview

- **FAO commissioned joint study from Öko-Institut, IFEU and Copernicus Institute on key environmental issues of bioenergy**
  - Develop Analytical Framework: **methods**
  - **Issues**: Life-Cycle GHG + direct and indirect LUC, air emissions & toxics, biodiversity, water, soil impacts
  - Approach: **compile** existing knowledge, use own analysis and scientific expertise
  - **Define** Data Categories and „Tool Box“
  - Application **not part** of current BIAS activities

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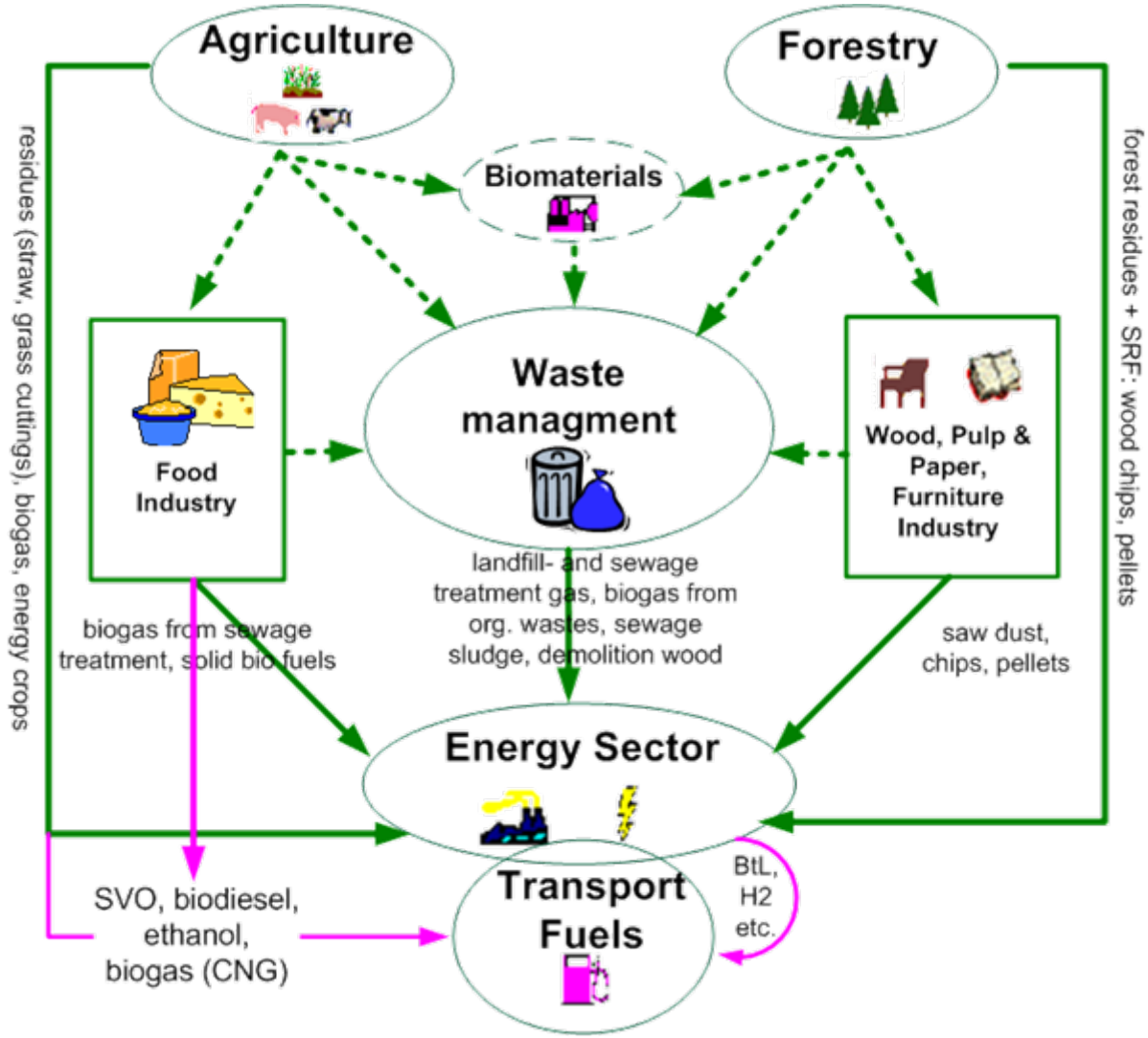
BIAS: Consider all Bioenergy Flows



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BIAS: Greenhouse-Gas Emissions

- **GHG accounting:**
  - Scope and data background
  - Allocation and system boundaries
  - Life-cycle analysis: full fuel-chain approach
  - GHG from direct and indirect land-use change
  - Links to EU and global GHG data and methodologies (EEA, GBEP, UNEP…)

→ Example: Sweet Sorghum (IFEU)

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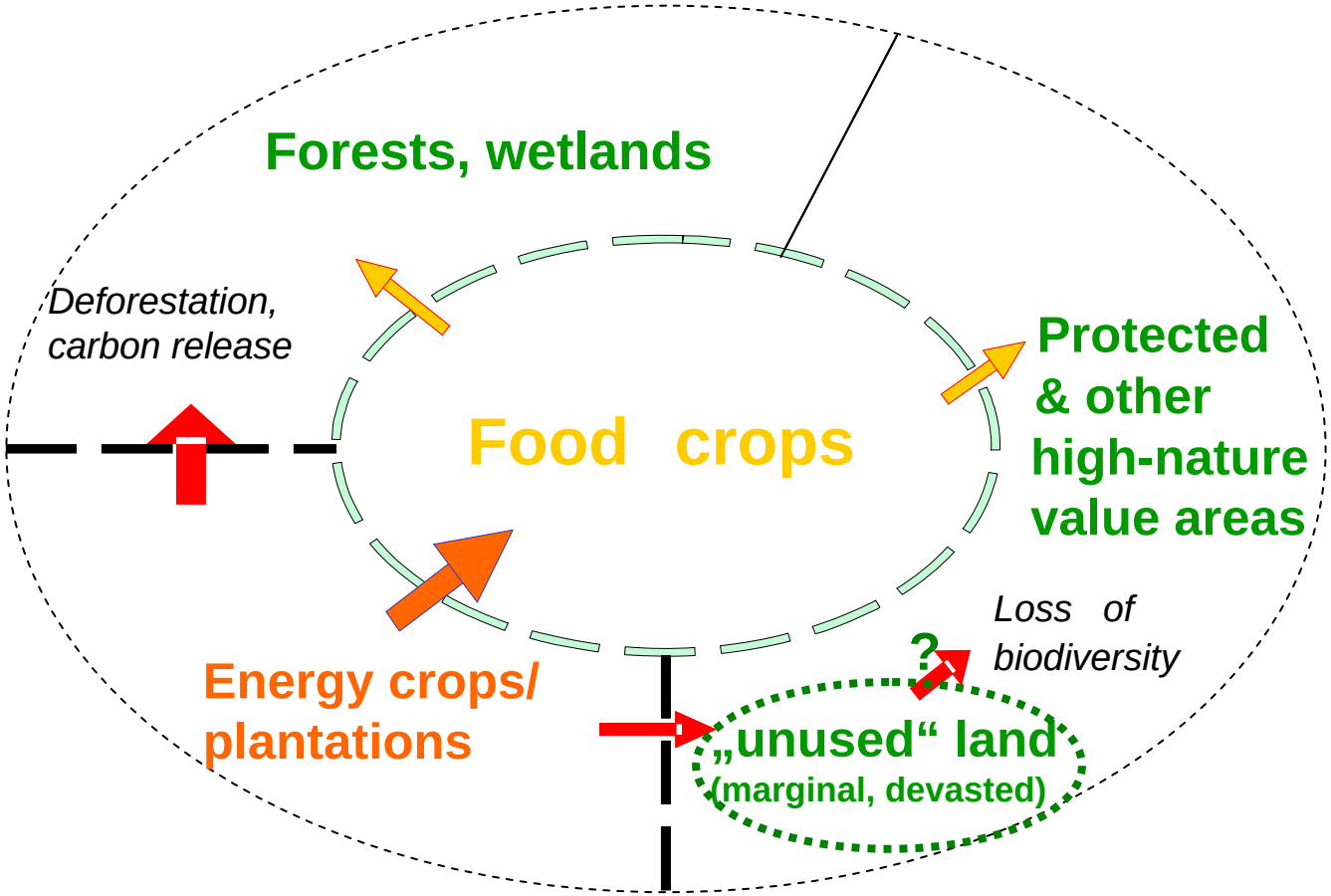
Bioenergy: Indirect Effects (Displacement)



Source: based on Girard (GEF-STAP Biofuels Workshop, New Delhi 2005)

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BIAS: GHG from indirect LUC

- **Displacement is a generic problem arising from restricted system boundaries**
  - Accounting problem of partial analysis („just“ biofuels, no explicite modelling of agro + forestry sectors)
  - All incremental land-uses imply indirect effects
- **Analytical <u>and</u> political implications**
  - Analysis: which displacement when & where?
  - Policy: which instruments? Partial certification schemes do not help, but have „spill-over“ effects

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BIAS: GHG from indirect LUC

- **Scientific considerations:**
  - Which methodology (risk adder, deterministic, econometric…) and scope (marginal vs. average)
  - Which data and time horizon

- **Policy considerations:**
  - Instruments for implementation?
  - Bonus for zero-risk options?

- **BIAS will contribute, not „resolve“ issue**

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BIAS: Air Emissions + Toxics

- **Accounting approach follows GHG accounting**
  - Additional data needs
  - „hot spot“ analysis

→ Example: Sweet Sorghum (IFEU)

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BIAS: Water and Soil

- **Define Water Use of Farming Systems**
  - Model and data research ongoing
  - Spatial data are key, but (yet) unclear
- **Research Soil Impacts**
  - Mapping of biophysical soil properties
  - Qualitative Impact Definition (for farming systems/AEZ)
  - Quantification?

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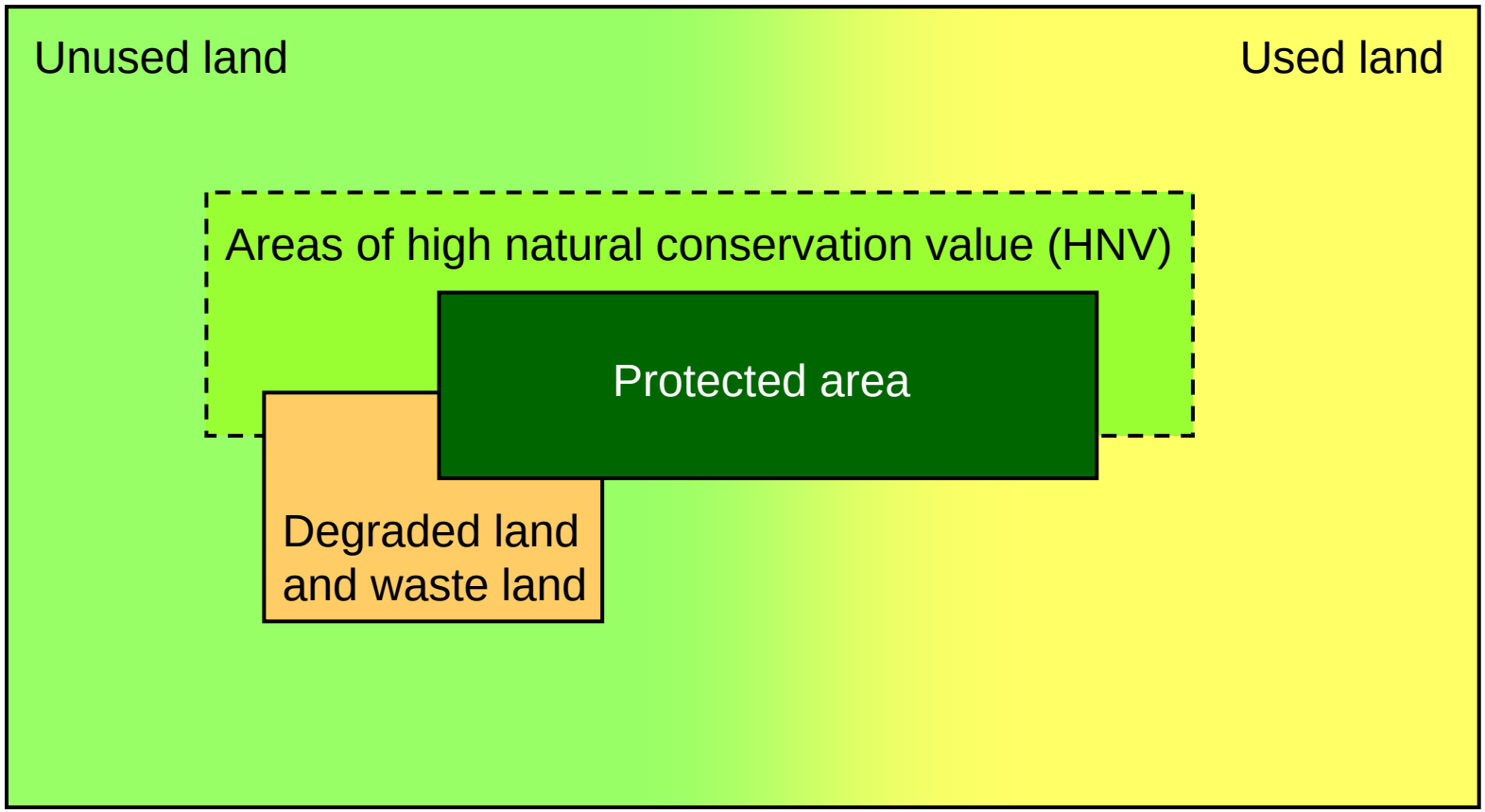
BIAS: Land Use and Biodiversity



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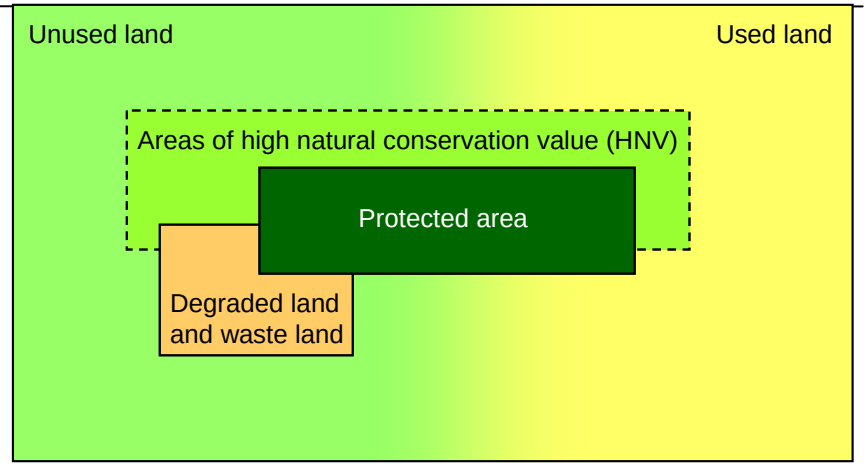
Global Land Categories: Protected Areas

- **Instrument to protect natural resources including biodiversity (IUCN, WCMC, CBD)**
- **Cornerstone of conservation strategies**
- **Represents biodiversity of each region**
- **International Databases: World Database on PA (WDPA), UN List of PA**



BUT:

- **Strategies for managing whole landscapes (production + protection) are needed for the protection of biodiversity.**
- **Large number of these species, ecosystems and ecological processes are not jet adequately protected (gap analysis)**

Definition of Protected Areas

IUCN:

Protected Areas are areas "of land and/or sea especially dedicated to the protection and maintenance of biodiversity, and of natural and associated cultural resources, and managed through legal or other effective means".

CBD:

Protected Area as "a geographically defined area that is designated or regulated and managed to achieve specific conservation objectives".

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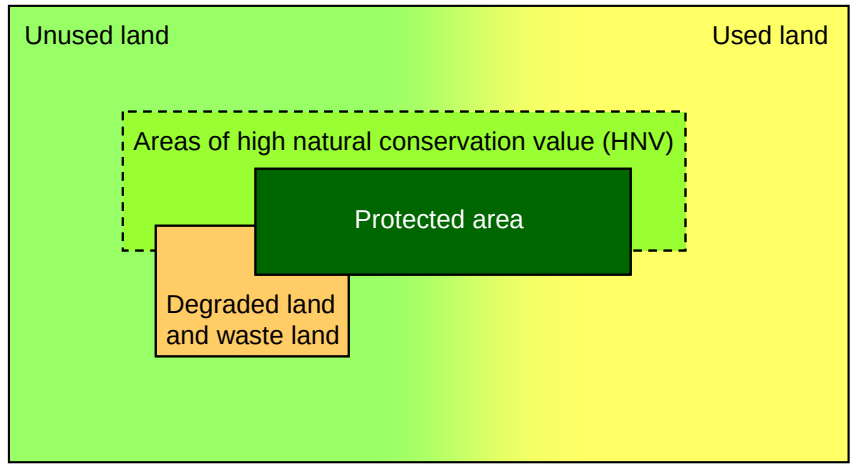
Global Land Categories: High-Nature Value

Areas of high natural conservation value (HNV)

- May **fill the gap** of Protected Area Network
- **Global databases** on areas important for conservation of biodiversity useful to identify HNV



BUT:

- No internationally **accepted definition** of HNV
- Many global data **too coarse** in resolution

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BIAS Approach: Map “key” biodiversity areas

Agro-Environmental Zones + Ecoregions

AEZ + ecoregions are international accepted units (Olson et al. 2001, WWF-database)

↓

Protected Areas (PA)

Location of Protected Areas is – at least – nationally known (WDPA, UN List of PA)

↓

Internationally accepted HNV (not yet PA)

Data basis of unprotected HNV available (e.g. Biodiversity Hot spots, Important Bird Areas, Important Plant Areas, etc.)

↓

Forests and wetlands

Data basis on forests (e.g. FAO) and wetlands (e.g. GLWD, Lehner & Döll 2004)

Data available in GIS format

↓

Global and national land cover maps

- GLC 2000 based on LCCS, update available in March 2008 (FAO, 300 m resolution)
- National land cover mapping (high resolution)
- **Change detection possible for monitoring**

Screening with criteria

↓

Identified PA + HNV for each ecoregion, including **“buffer zones”**

…identification of HNV must use clearly defined international criteria; buffer zones around areas

↓

“no-go” areas and potential biomass grow areas identified; satellite monitoring possible

PA+HNV areas are “no-go” → other areas **might** be suitable for biomass development, depending of further qualification (water, social issues…)

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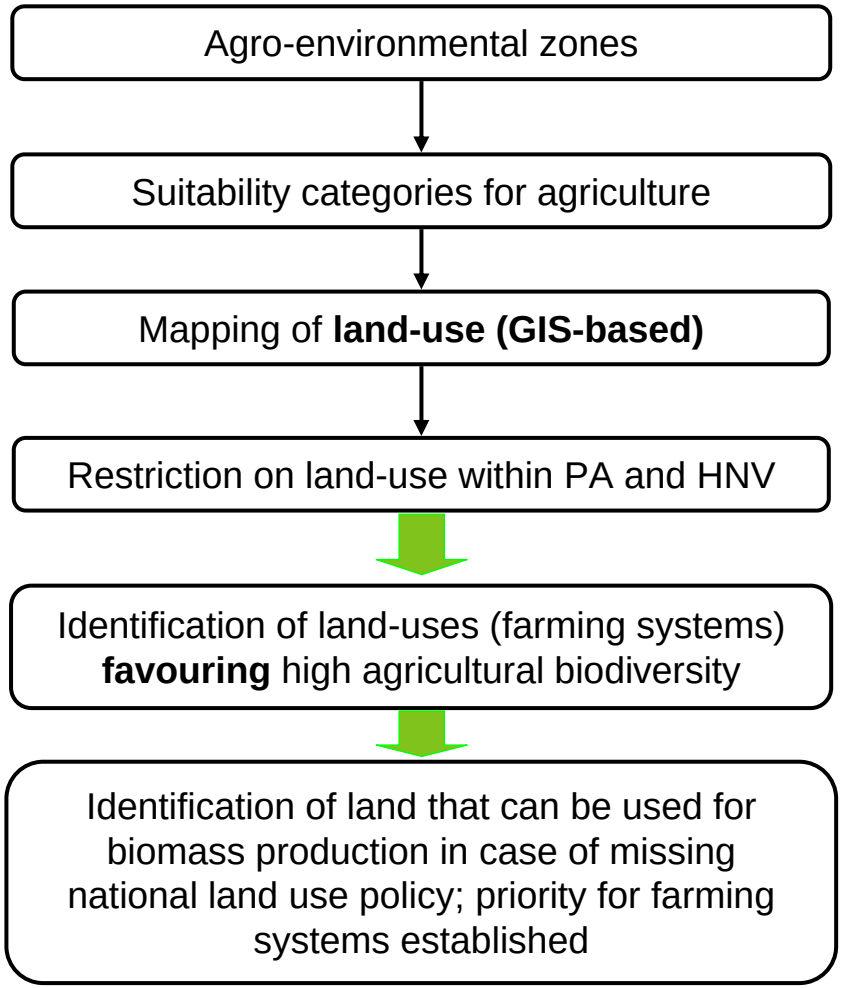
BIAS: Agrobiodiversity…



AEZ are meaningful and international accepted unites (Fischer et al. 2000, FAO 2005)

Biophysical database from FAO and IIASA 2007, project report available in March 2008

Worldwide data exist (e.g. Agro-MAPS, Land Use System LUS), but with low resolution

…based on existing PA, identified HNV and criteria for sustainable resource uses…

…identification of land-use forms including landscape structuring must follow clearly defined international criteria…

…production has to be **strictly limited** to areas (degraded land, idle land) which are not in use and do not shelter HNV…

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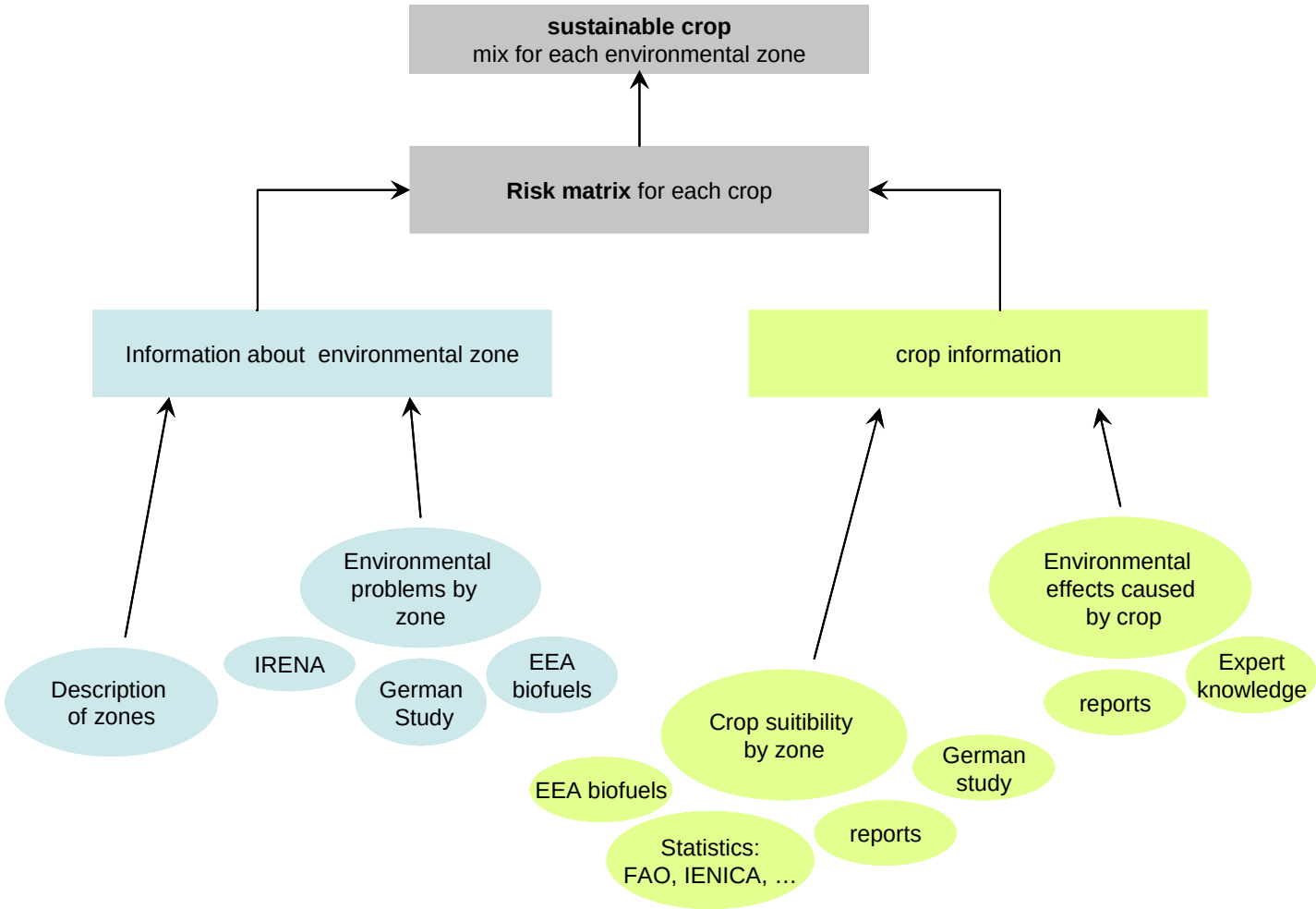
EEA Sustainable Crop Mix

European Environment Agency



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BIAS: Further Biodiversity Process

- **Identify relevant GIS-based data sets (ongoing)**
- **Preliminary definition of adequate criteria for HNV**

Future (potential BIAS application):

- **Pilot project(s) on mapping and screening (GIS-supported)**
- **Develop monitoring schemes (remote sensing via satellites)**
- **Agreement on "compatible" farming systems**

→ **Partnering with other initiatives and securing of adequate funding; collaboration with (pilot) certification, and private sector**

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BIAS: Further Activities (partially UBA-funded)

- **Finalize Analytical Framework; links to BEFS**
- **Input to GBEP**
  - GHG Task Force (US-lead) + Sustainability + biomass field projects Task Force (UK-lead)
- **EEA project on Bioenergy LCA (**GHG accounting methodologies, workshop in June 2008)
- Input to MDB Biofuels Working Group (upcoming; IDB)
- **Collaborate with UNEP:** GEF project; Resource Panel

- **Application of BIAS (in Case Studies)?**

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BIAS: Beyond traditional crops?

- **Data for environmental analysis mainly EU and US**
- **FAO data on farming systems and „mapping“ mainly for traditional crops**

- **Bioenergy cropping could be different – see SRC, perennial grasses, jatropha**

→ A few examples (beyond jatropha)

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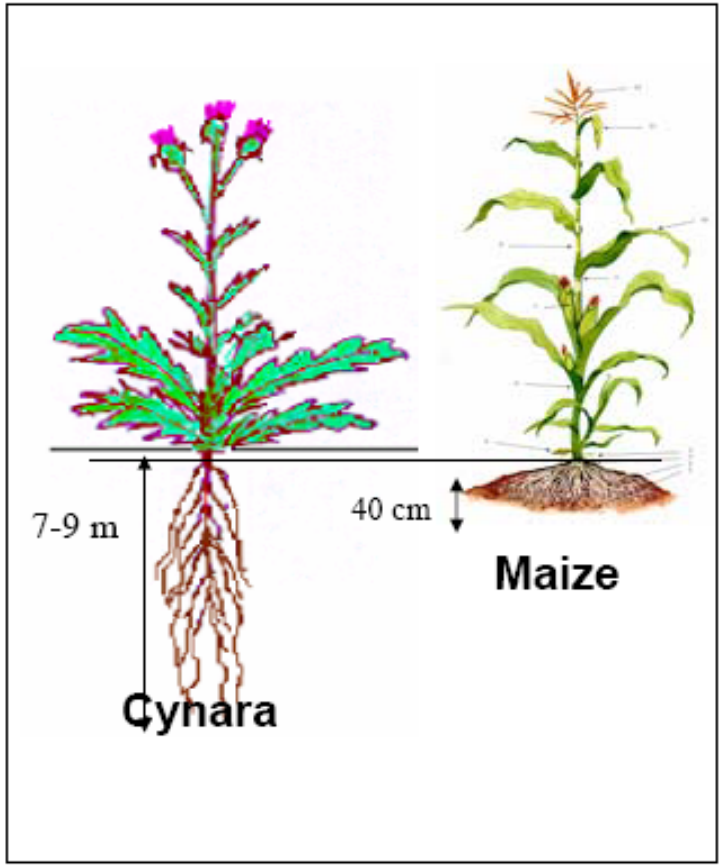
“New“ Bioenergy Crops: More than Jatropha

CYNARA

- 10 months growth cycle lenght (October – July)
- Growth cycle adapted to the Mediterranean distribution of rainfalls (autum, winter, spring)
- Deep root system
- Aerial plant parts dry up in summertime (no transpiration)
- Perennial crop



MAIZE

- 4 months growth cycle length (June-September)
- Irrigation is needed in the Mediterranean region (no rainfalls in summer)
- Shallow root system
- Active canopy in summer ⇒ high transpiration rate
- Annual crop

Source: JRC/EEA 2006 (Proceedings Sust. Bioenergy in the Mediterranean)

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“New“ Bioenergy Crops: More than Jatropha

Cynara (*Cynara cardunculus*)

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WILD TOBACCO (*Nicotiana glauca*)

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“New“ Bioenergy Crops: More than Jatropha

Prickly Pear (*Opuntia ficus-indica*)

Source: University of Madrid, Prof. Jesús Fernández

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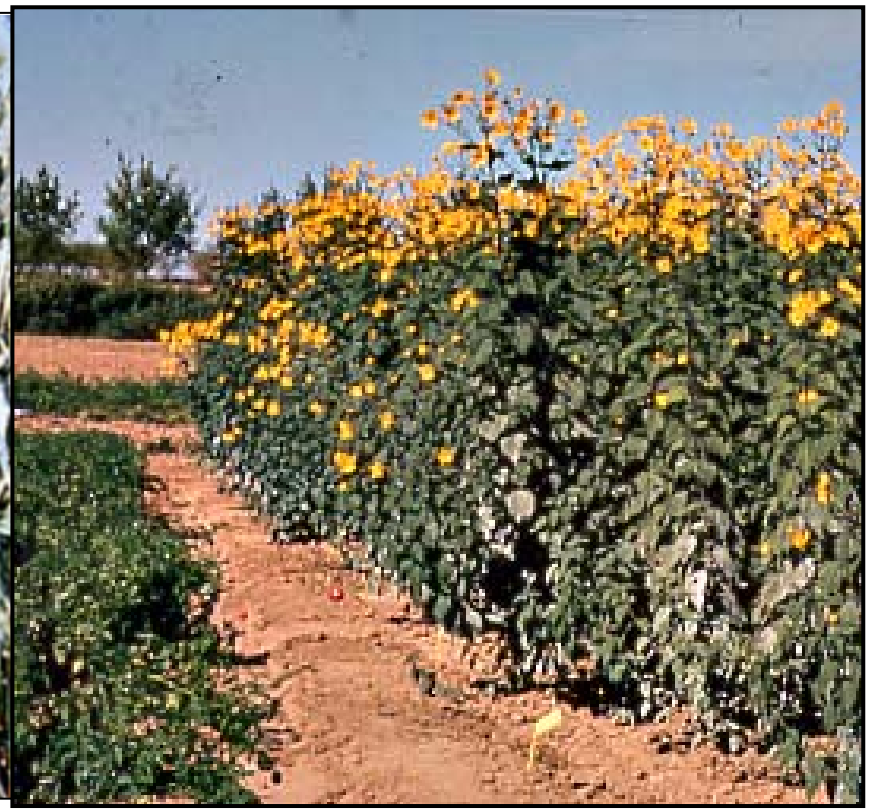
“New“ Bioenergy Crops: More than Jatropha

Sweet Sorghum
(*Sorghum bicolor*)



Jerusalem Artichoke
(*Helianthus tuberosus*)

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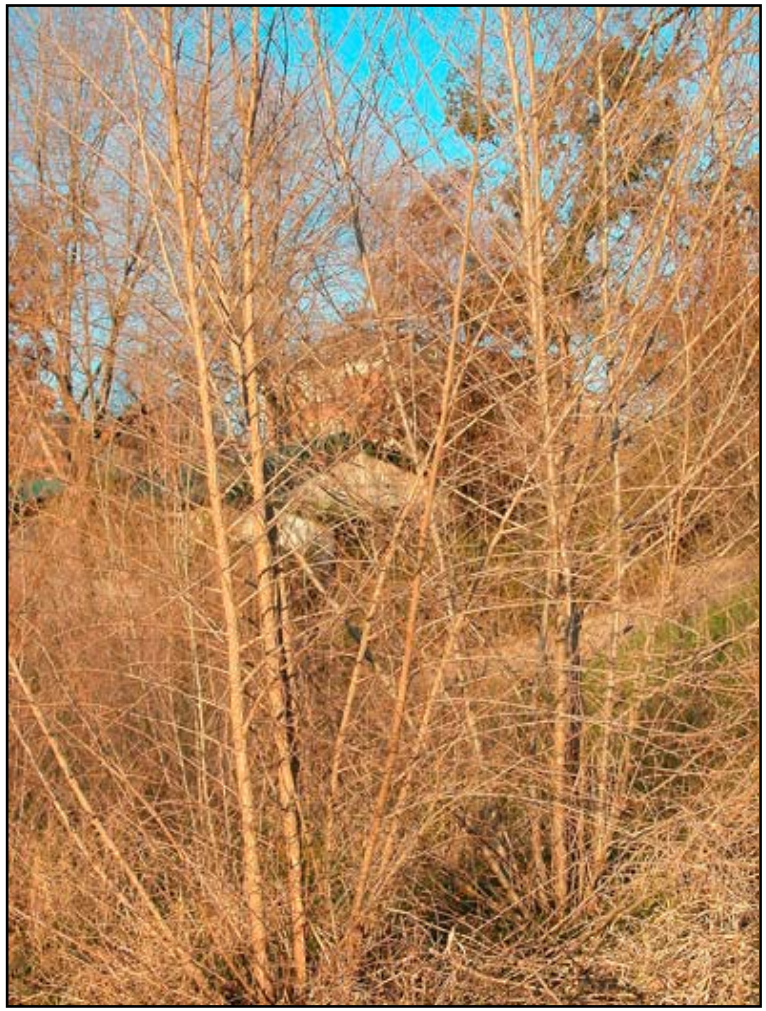

Siberian Elm (*Ulmus pumila*) in SRF in Spain

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