"FINGERPRINTING" NATURE-DEPENDENT COMMUNITIES

A **flexible framework** for linking Earth Observation and ground-based survey data to **quantify community dependence**

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People in Nature

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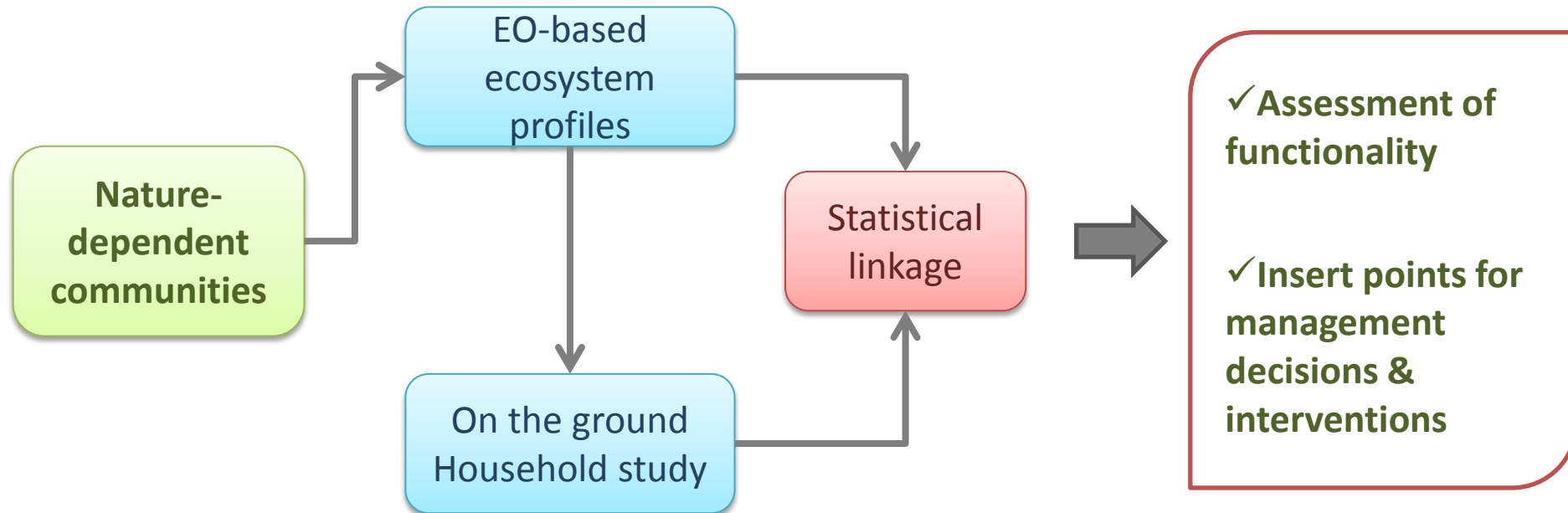
Understanding the people-nature relationship

- Flexible conceptual framework that links

  1) **Earth Observation (EO)** to

  2) **ground-based survey data (in situ)**

- for *analyzing* community dependence and

- *depicting communities at risk* using specific Community Fingerprints and EO ecosystem profiles

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Analysing people-nature dependence

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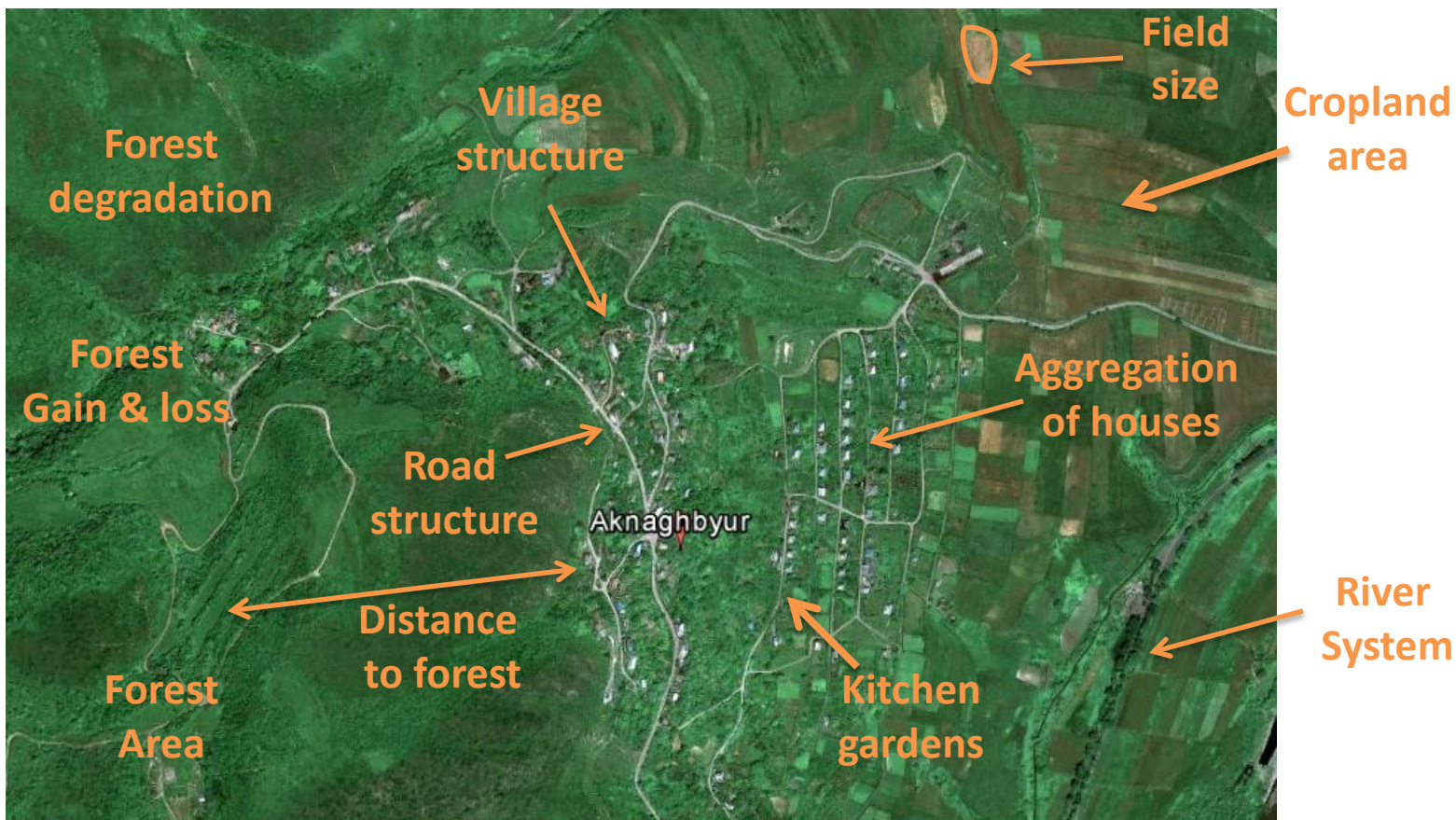
Define nature-dependent communities

- **Focus region:**
  - 36 selected communities across the ENPI East countries and Russia
    - Community selection by field consultants and FLEG Country Program Coordinators
    - Represent a variety of forest-dependent communities ranging from very small and isolated communities to larger communities that have access to main roads and markets.
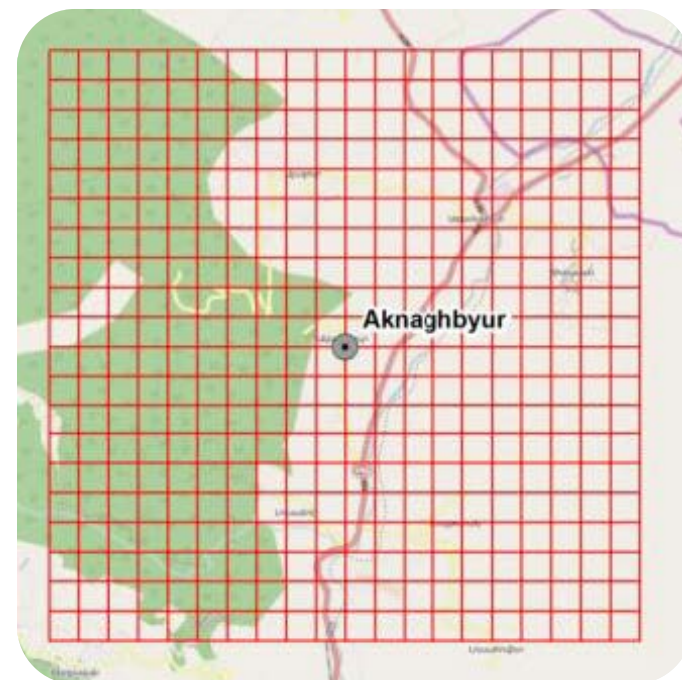
Quantify the relationship between communities and their natural environment using satellite imagery

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Derive EO-based ecosystem profile

- **76 EO-based variables**
- **6 Parameter groups:**
  - Landscape characteristics
  - Villages structure
  - Infrastructure
  - Agriculture
  - Forest
  - Hazards

- 10x10km grid (100km²) with grid size of 500m was used to standardize the process

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IUCN Household survey

- **Intensive household studies were performed by IUCN**
  - Criteria of World Bank Living Standards Measurement Survey and the Center for International Forestry Research (CIFOR) Poverty Environment Network applied
  - Approximately 1250 households involved in 7 countries
  - Detailed information on village and household levels was gathered on:
    - Demography and education
    - Forest-based knowledge
    - Household economy and household assets
    - Village infrastructure

3.5 Mio Entries

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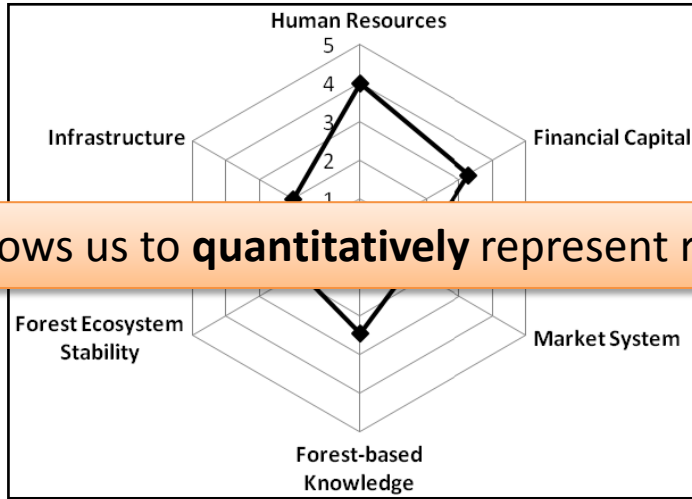# Forest Community Fingerprints from IUCN household survey

- **Centrepiece of the framework**

- **Pre-Assessment:**
  – Helps to define strategic intervention targets (pre-assessment)

- **Post-Assessment:**
  – Were resources used wisely?
  – Did targeted intervention produce desired results?

- Provides a way to identify whether a community is at risk, in transition or stable

HUMAN RESOURCES

INFRASTRUCTURE

FINANCIAL CAPITAL

FOREST COMMUNITY FINGERPRINT

FOREST ECOSYSTEM STABILITY

MARKET SYSTEM

FOREST - BASED KNOWLEDGE

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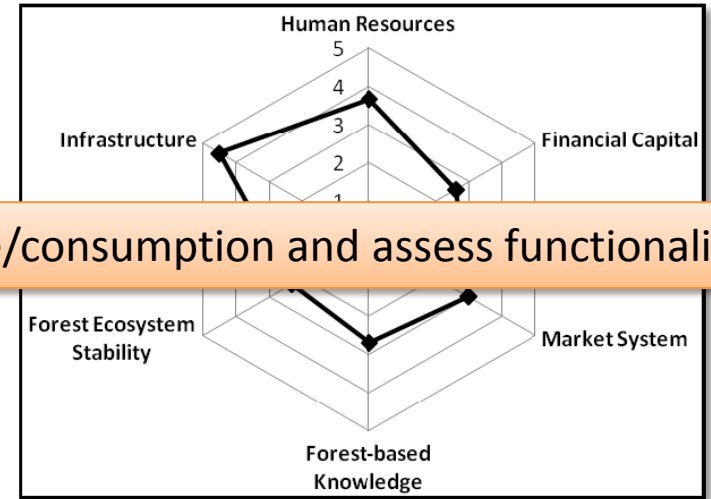
Forest Community Fingerprint

- Spider Web Diagrams

Community at risk

Tsevlo - Russia

Stable community

Sakdrioni - Georgia

Allows us to **quantitatively** represent resource use/consumption and assess functionality

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Forest Community Fingerprint

- Relative ranking of forest-dependent communities across large region

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How to combine the EO-based ecosystem profiles and the ground based survey data?

Spatial pattern

Household pattern

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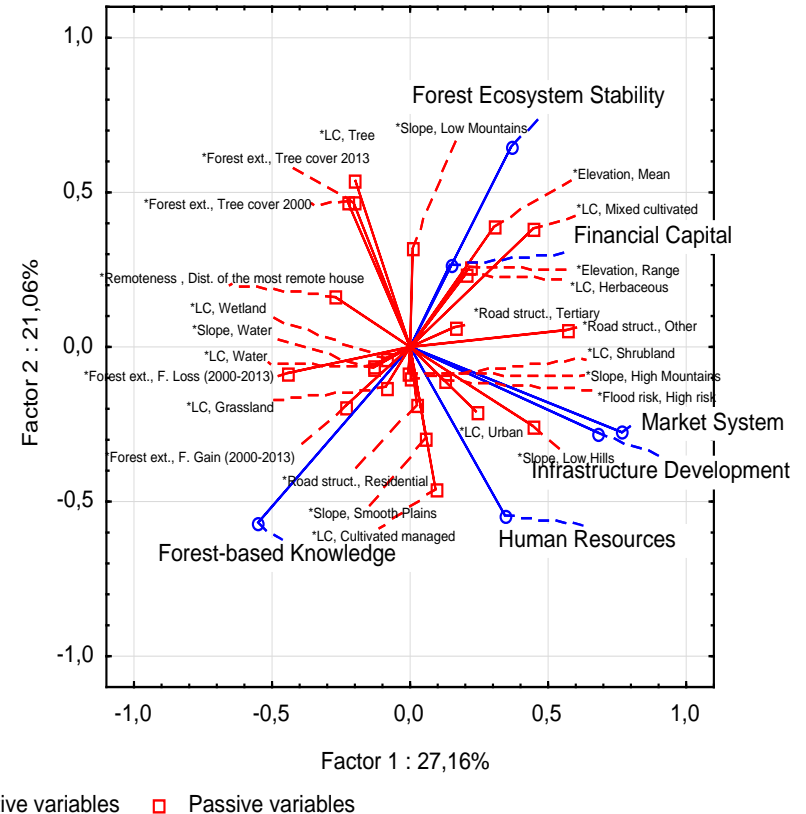# Establish statistical link between HHs and EO data

- **Step 1: General Linear Modelling (GLM)**
  - Extracts the most significant drivers among EO parameters
  - Assesses percentage of variance explained these drivers

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Establish statistical link between HHs and EO data

- **Step 2: Principal Component Analysis (PCA):**
  - Defines the direction and confirms the overall strength of the relationship between significant drivers among EO parameters and the six FCF parameters

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Establish statistical link between HHs and EO data

- **Step 2: Principal Component Analysis (PCA)**

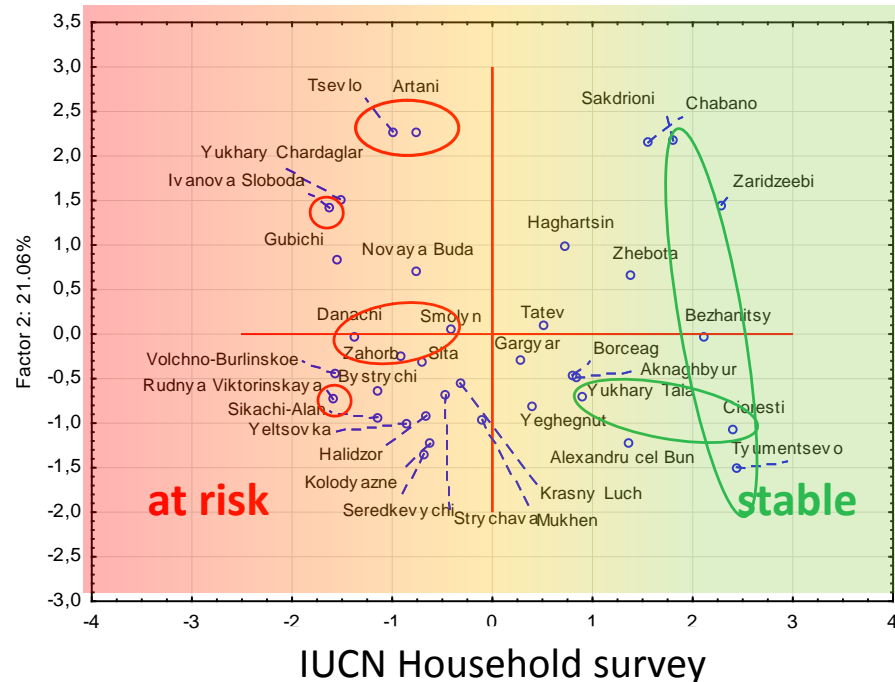| FCF parameter	Positive correlation with EO parameter	Negative correlation with EO parameter
Financial Capital	Elevation Mean Land cover, mixed cultivated land	Forest Extent, Forest Gain (2000-2013)
Forest Ecosystem	Elevation, Mean	Forest Extent, Forest Gain (2000-2013)
Market System	Land Cover, Urban Slope, Low Hills	Remoteness, Distance of the most remote house from a main street
Infrastructure Development	Land Cover, Urban Slope, Low Hills	Remoteness, Distance of the most remote house from a main street
Human Resources	Land Cover, Cultivated land Land Cover, Urban Territories	Forest extent, Tree Cover 2000 and 2013 Land Cover, Trees

→ **PCA and GLM confirmed the linkage between the HHs data and the EO-based ecosystem profile**

Establish statistical link between HHs and EO data

- Scatterplot for FCF and EO-based ecosystem profile show similar patterns

Forest Community Fingerprint

"Fingerprinting" forest-dependent communities – Linking EO and household data for assessing sustainability and resilience
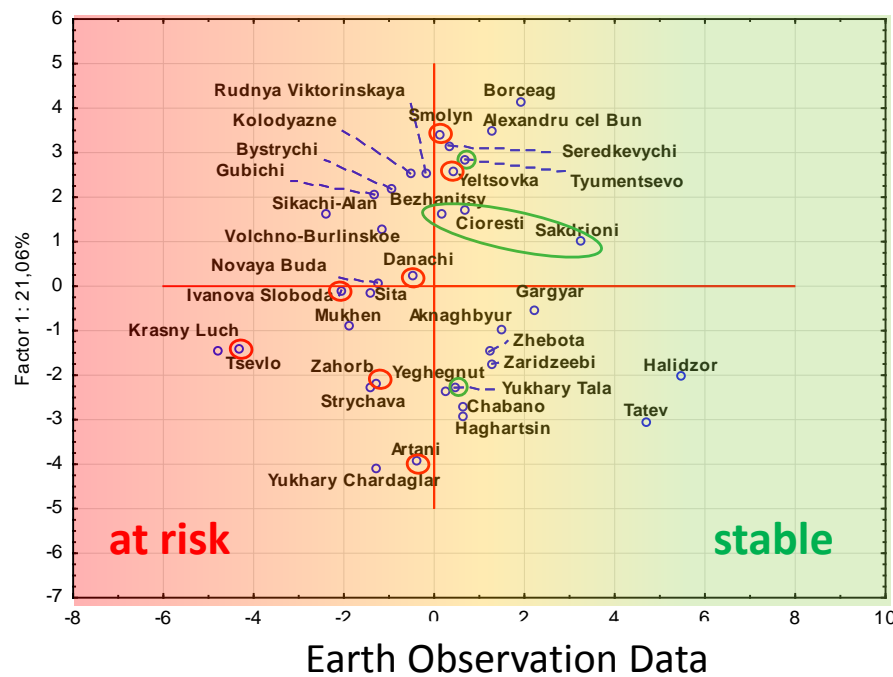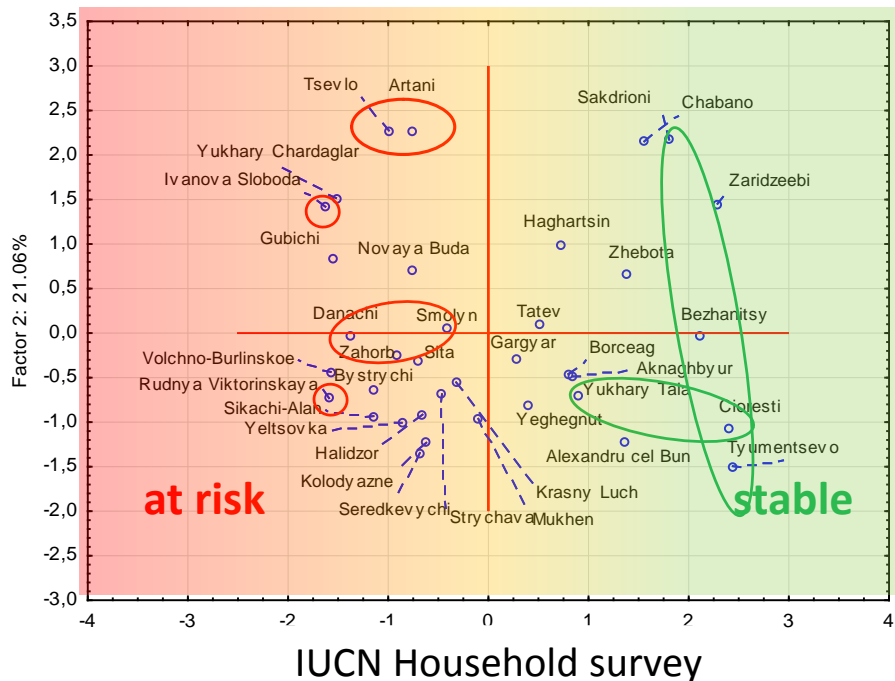
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Establish statistical link between HHs and EO data

- Scatterplot for FCF and EO-based ecosystem profile show similar patterns

Forest Community Fingerprint

EO-based ecosystem profile

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Establish statistical link between HHs and EO data

- Comparing the FCF assessment and FCF-PCA results
  - 31 out of 36 communities align (≈86%)

		EO-PCA	
		at risk	**stable**
FCF-PCA	**at risk**	Artani, Bystrychi, Danachi, Gubichi, Kolodiazne, **Krasnyi Luch**, **Mukhen**, Novaya Buda, Rudnya Viktorinskaya, Sikachi Alan, **Sita**, Strychava, Tsevlo, **Volchno Burlinskoe**, Yukhari Chardakhlar, Zahorb	Halidzor, Seredkevichy, Smolyn, **Tyumentsevo, Yeltsovka**
	stable		Aknaghbyur, Alexandru cel Bun, Bezhanitsy, **Borceag**, Chabano, Cioresti, Gargar, Haghartsin, Ivanova Sloboda, Sakdrioni, Tatev, Yeghegnut, Yukhari Tala, Zaridzeebi, **Zhebota**

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In a nutshell….

1) A flexible framework to quantify people-nature relationships

People in Nature

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In a nutshell….

2) **Forest Community Fingerprint:**

- identifies **insertion points** in the community development

- helps to **define priorities** in community development

- make **targeted policy** and **management strategy**

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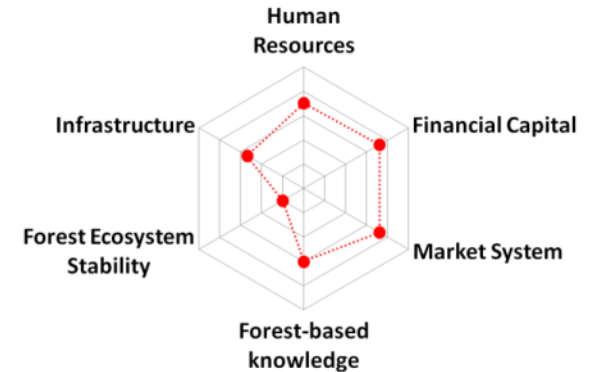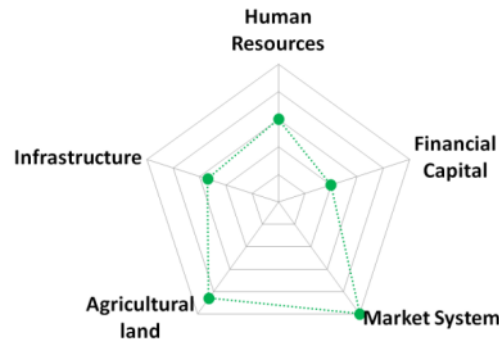
In a nutshell….

3) Community fingerprints can be adapted to specific conditions

– Change FCF parameters

– Change the number of FCF parameters

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In a nutshell….

4) Accuracy can be improved by using high resolution Data

WorldView-2 – 0,5m

RapidEye – 5m

Landsat – 30m

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Outlook

- Additional testing, both deeper application and wider geographic distribution
  - Includes both, other forest ecosystems as well as other ecosystems e.g. agricultural land

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Thank you!

Geo-spatial Patterns

Forest Community Fingerprint

Poverty Assessment

Human Resources

Infrastructure

Financial Capital

Forest Ecosystem Stability

Market System

Forest-based knowledge

Low   High

Household assets

Net Forest Income

HUMAN – NATURE DEPENDENCY ASSESSMENT

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