Tools for assessing ecosystem co-benefits of REDD+

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Natural Capital Project

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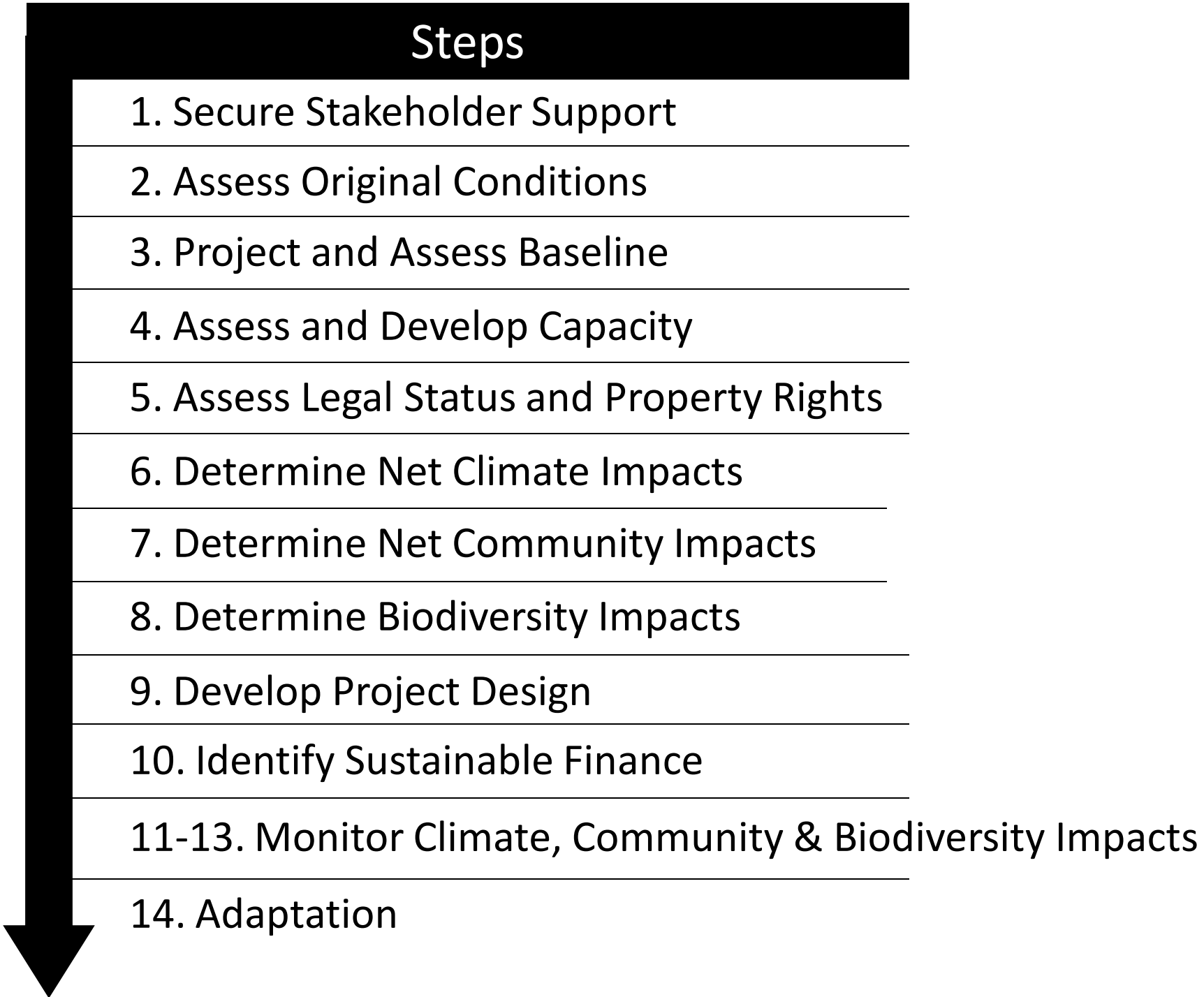
Woods Institute for the Environment Stanford University

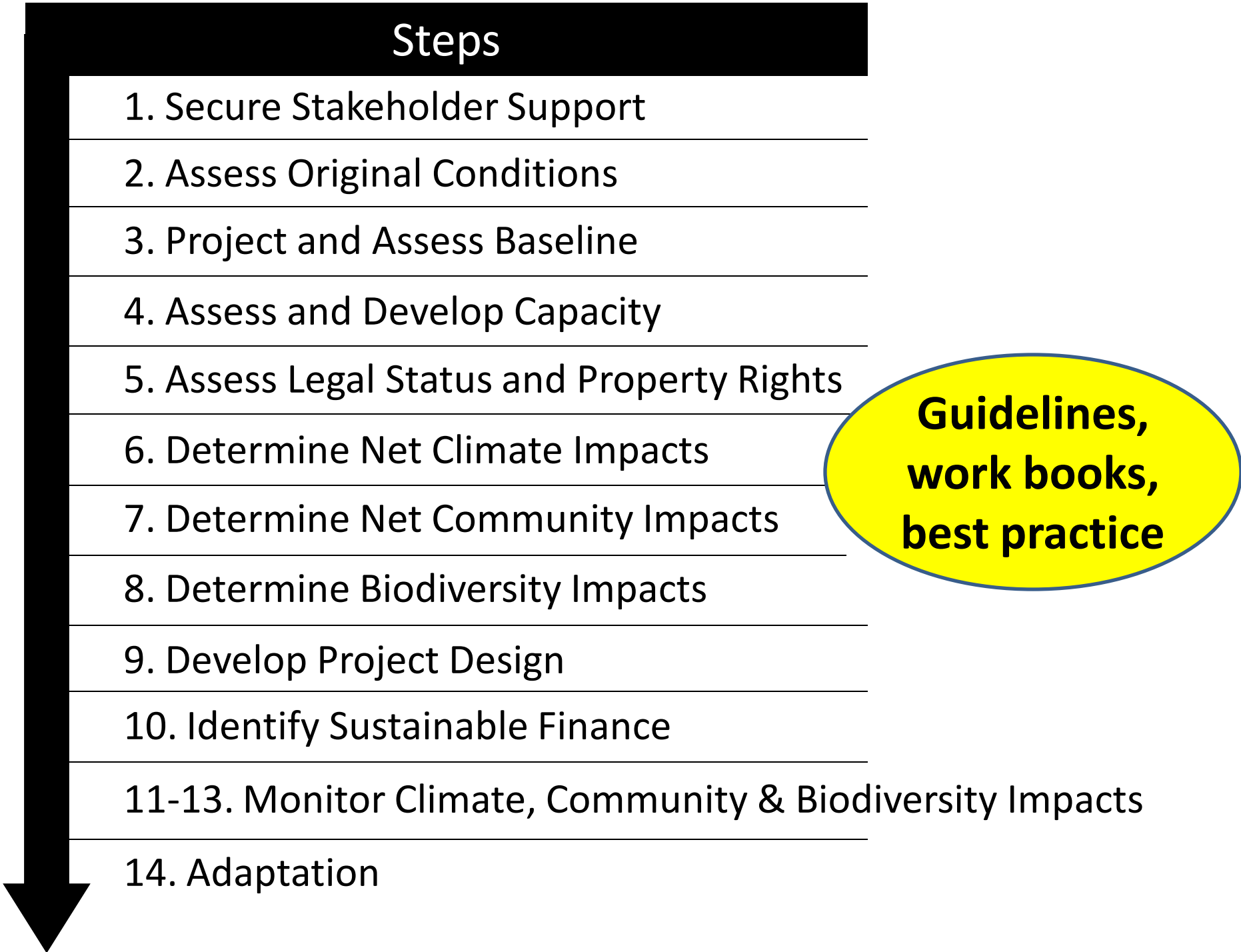
WWF

The Nature Conservancy

Outline

- Setting the scene: co-benefits assessment tools
  - Different steps in carbon offset projects
  - What are tools used for? Why are they needed?
- InVEST
  - Introduction and overview
  - Examples: Indonesia and Tanzania
- Other tools
  - ARIES
  - Single service models


Steps
1. Secure Stakeholder Support
2. Assess Original Conditions
3. Project and Assess Baseline
4. Assess and Develop Capacity
5. Assess Legal Status and Property Rights
6. Determine Net Climate Impacts
7. Determine Net Community Impacts
8. Determine Biodiversity Impacts
9. Develop Project Design
10. Identify Sustainable Finance
11-13. Monitor Climate, Community & Biodiversity Impacts
14. Adaptation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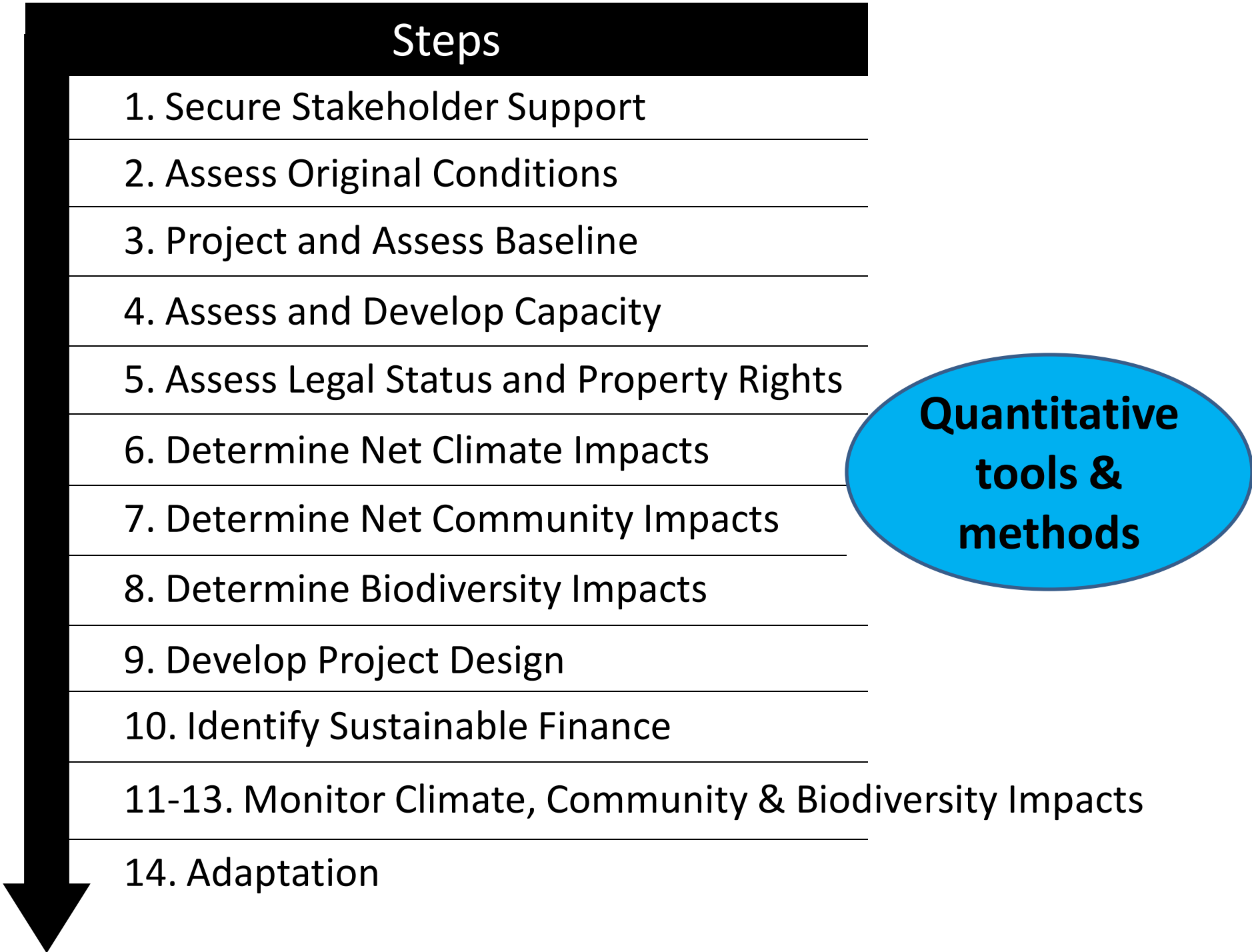
Guidelines, work books, best practice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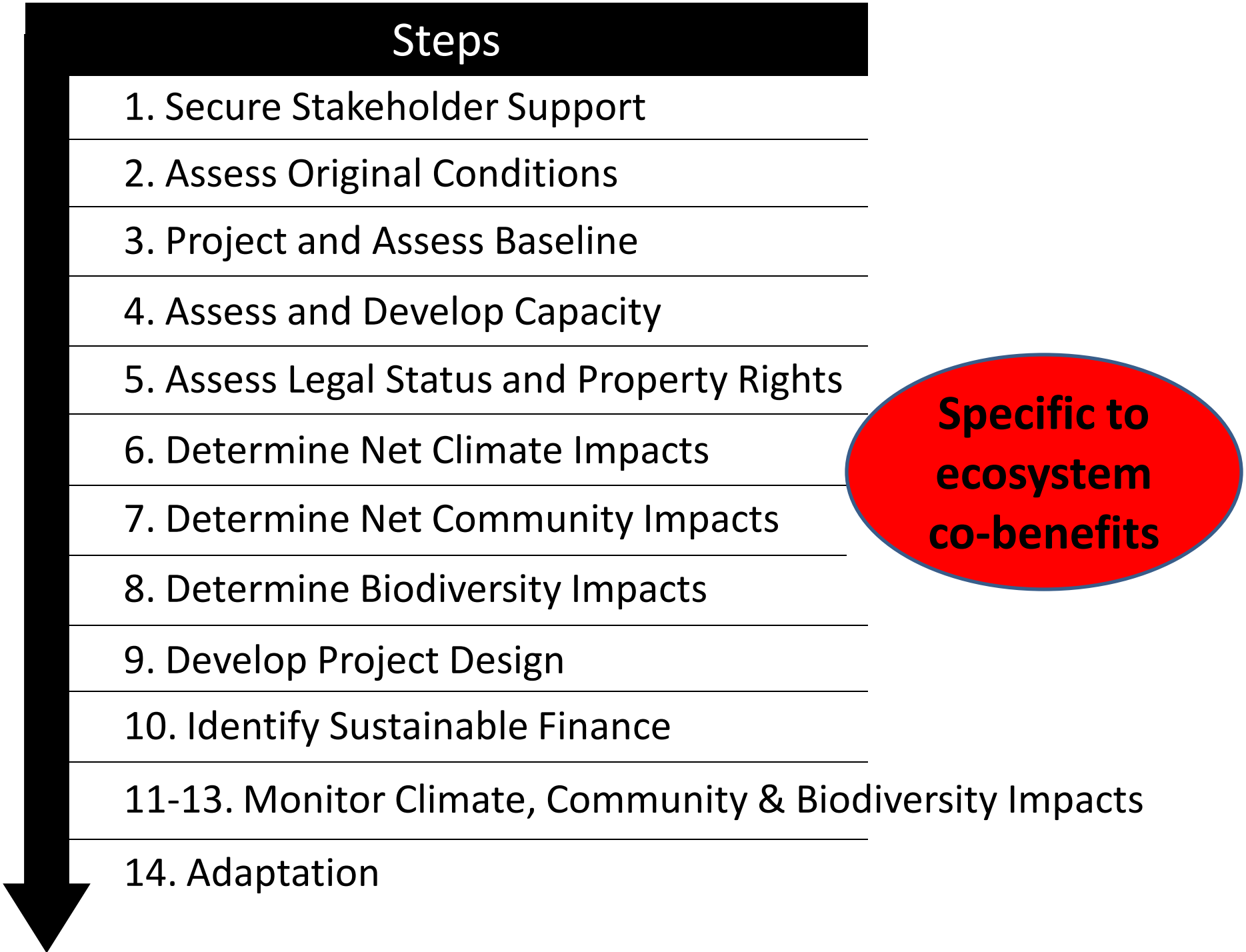
Quantitative tools & methods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Specific to ecosystem co-benefits

Critical co-benefits questions

- How are ecosystem services and biodiversity currently provided on the landscape?
- How would they change under future baseline?
- How would they change with a REDD+ project?
- How *did* they change with a REDD+ project?

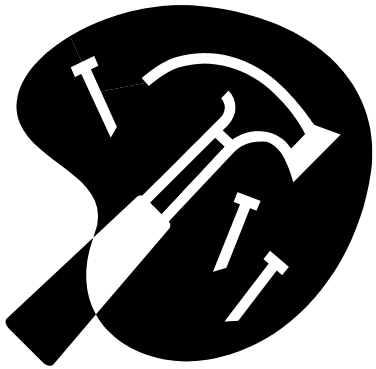
Benefits of answering these questions

- Stakeholders
  - Identify stakeholders with interest in co-benefits
  - Stimulate discussion and stakeholder engagement
  - Build local support & enable informed negotiations
- Project effectiveness
  - Select the best projects
  - Improve project efficiency
  - Enable learning and adaptive management
- ‘Sell’ at a premium and achieve co-benefits

Why the need for ‘tools’?

- Too few studies, having too little impact
  - Expensive, difficult and interdisciplinary
  - Heavy data demands
  - Tend to be conducted by consultants/academics

- Tool development
  - Make analyses quick, easy, accessible
  - Enable use of a co-benefits approach



What characteristics must tools have?

- Multiple co-benefits – biodiversity & services
- Quantitative – biophysical estimates & econ values
- Spatially explicit – mapped
- Usable at a range of scales
- Driven by scenarios - e.g. with & without REDD
- Adaptable – simple or complex

What does NatCap do?

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1. Develop new ecosystem service science and tools

2. Apply new approaches in demonstration sites globally

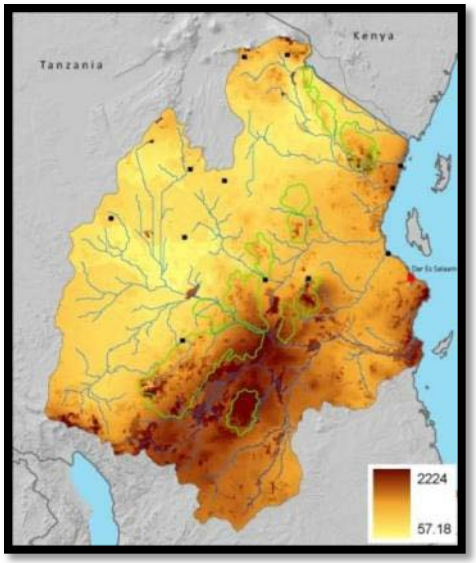
3. Magnify our impact by engaging with leaders

www.naturalcapitalproject.org

What tools has NatCap developed?

InVEST: Integrated Valuation of Ecosystem Services and Tradeoffs

Objective:
Enable users to quantify, map & value the ecosystem service impacts of alternative land use decisions



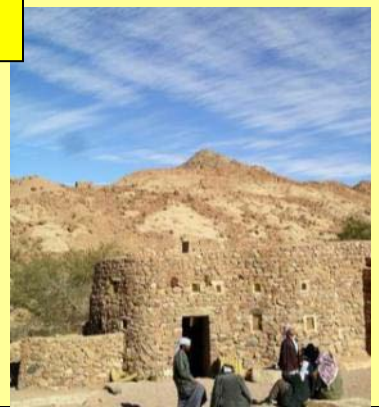
Embed in context of clear policy needs
e.g. REDD, but also strategic environmental assessments, land-use planning, payments for ecosystem services, PRSPs, marine spatial plans, offsets

Characteristics of InVEST

- Biodiversity and multiple services
- Biophysical or (first estimate) economic values
- Spatially explicit (mapped)
- Tiered design: simple or complex
- Driven by user specified scenarios
- Usable at a range of scales

Free and open source
http://invest.ecoinformatics.org





Multi-service: What's ready now?

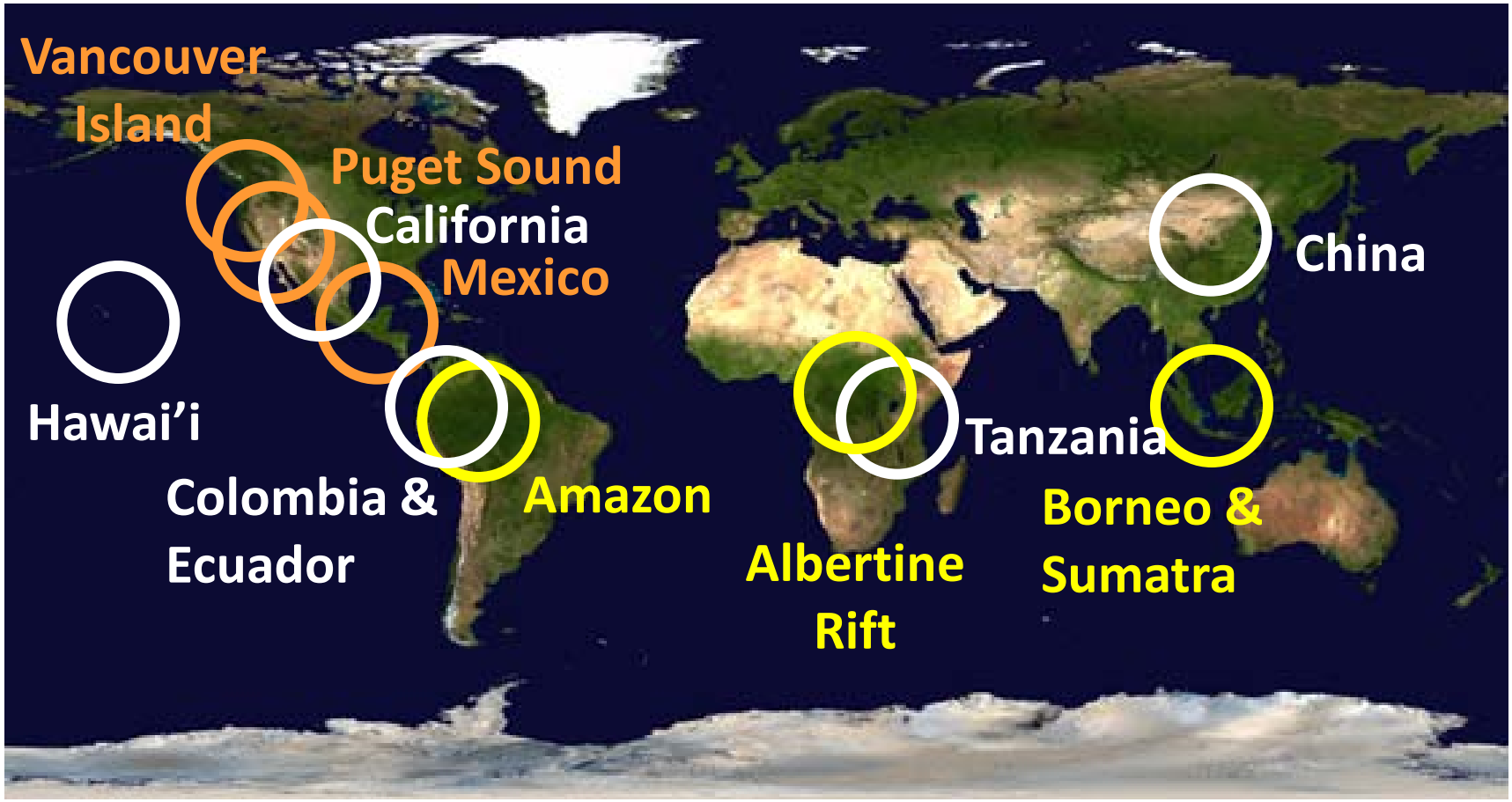
- Biodiversity (proxy)
  - Habitat rarity and integrity
- Ecosystem services
  - Carbon storage and sequestration
  - Avoided reservoir sedimentation
  - Hydropower production
  - Crop pollination
  - Commercial timber production
  - Water purification: nutrient retention
  - Storm peak flow mitigation
  - Open-access harvest
  - Irrigation water (for agriculture)
  - Agricultural production
  - Recreation and tourism
  - Cultural and aesthetic values

The InVEST Modeling Approach

- Use production functions
  - ES as function of land cover & other variables
  - Standard & widely applicable models
- Usable with relatively limited data
- Ready to use out-of-the box, but customizable



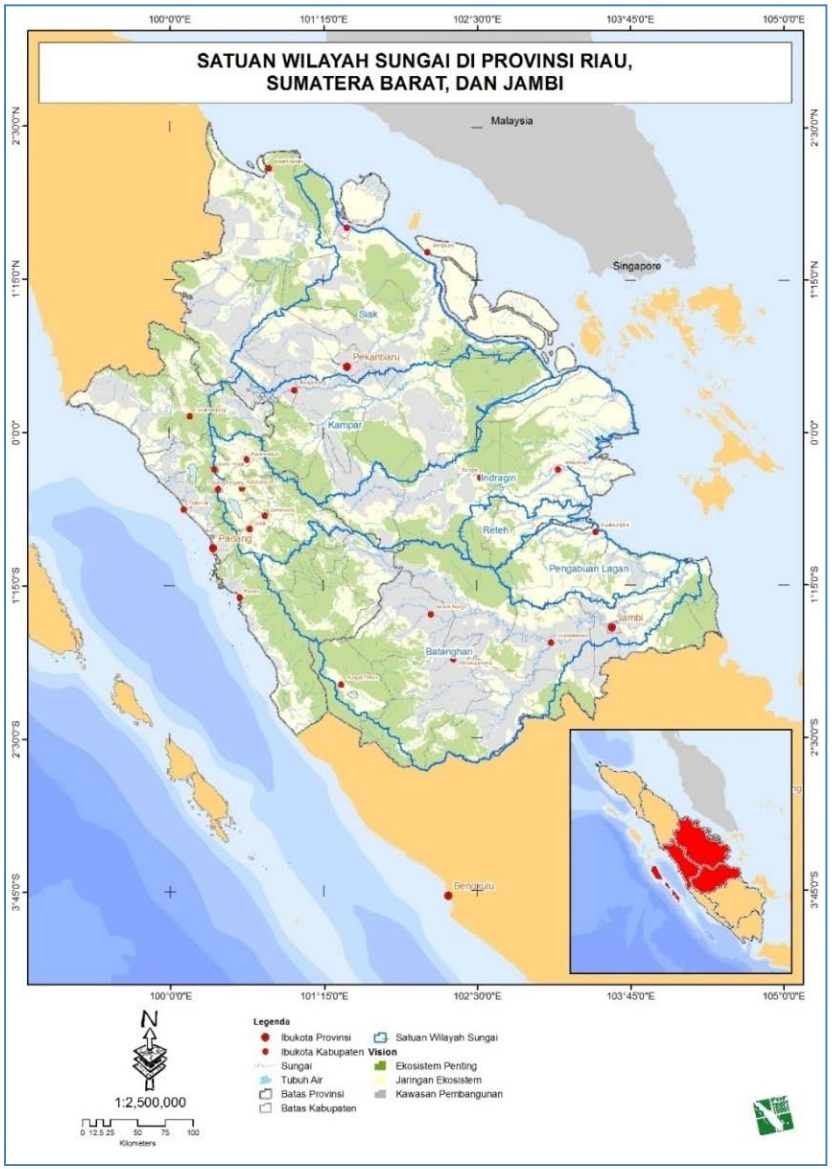
InVEST demonstration sites

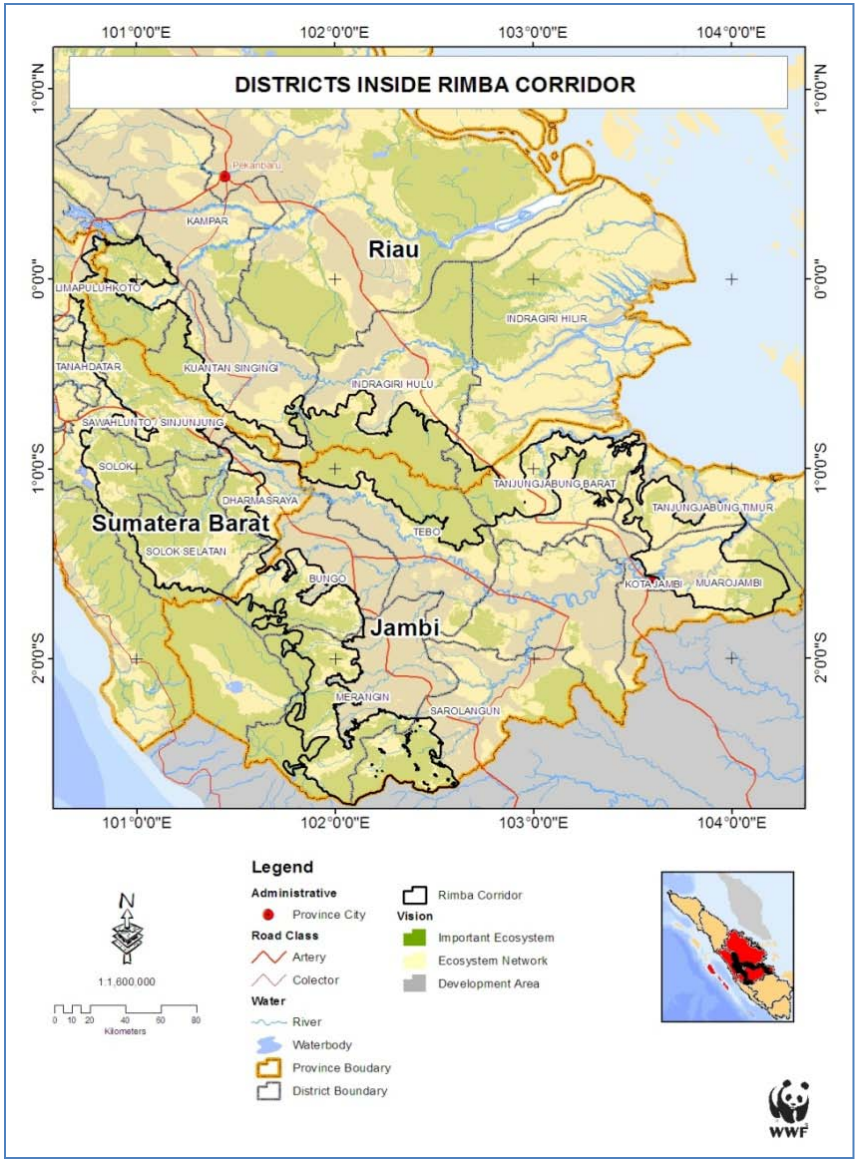


Sumatra, Indonesia

- Policy Context: Land-use planning
- Lead Partner: WWF Indonesia
- Objective: Inform and catalyze sustainable financing (includes REDD and water payments)

Watersheds of Central Sumatra: ‘Rimba corridor’





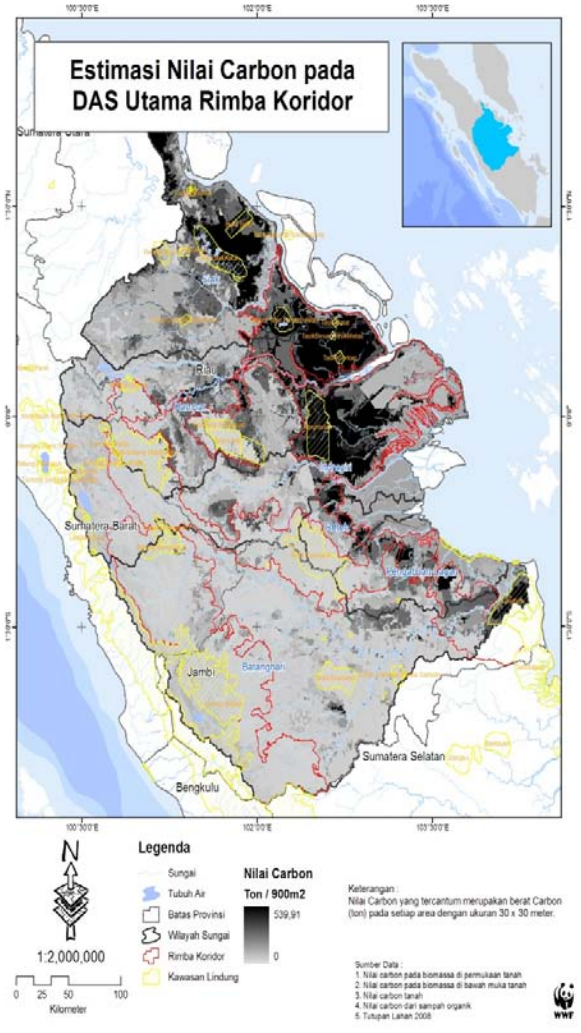
First workshop

- Technical (mapping) and policy staff from WWF and government agencies
  - Public works
  - Forestry
  - Environment
  - Home affairs

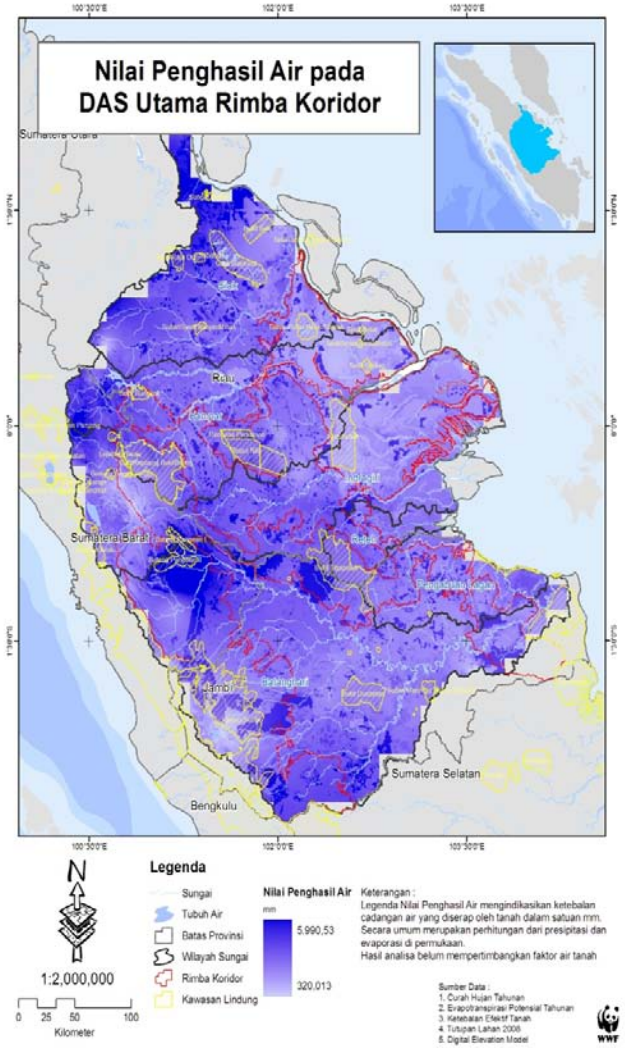
- InVEST training, policy discussions, work planning

Early results

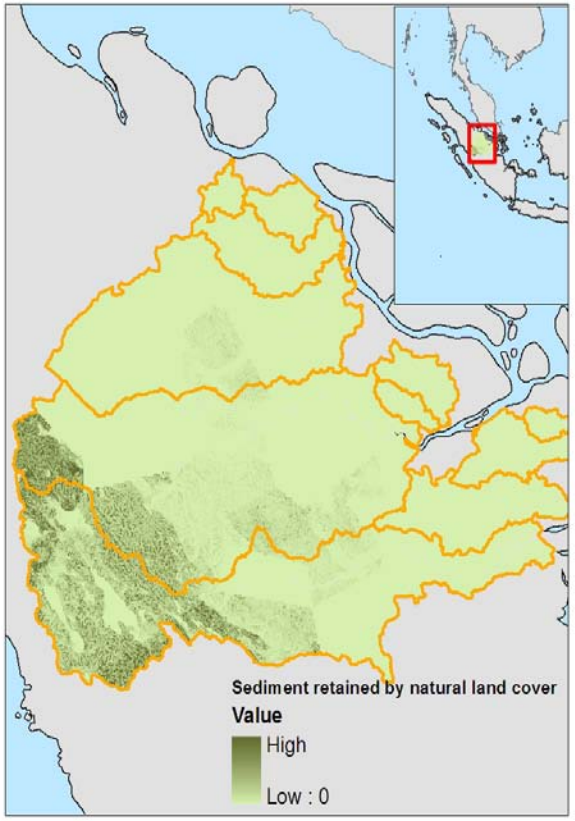
Carbon



Water yield

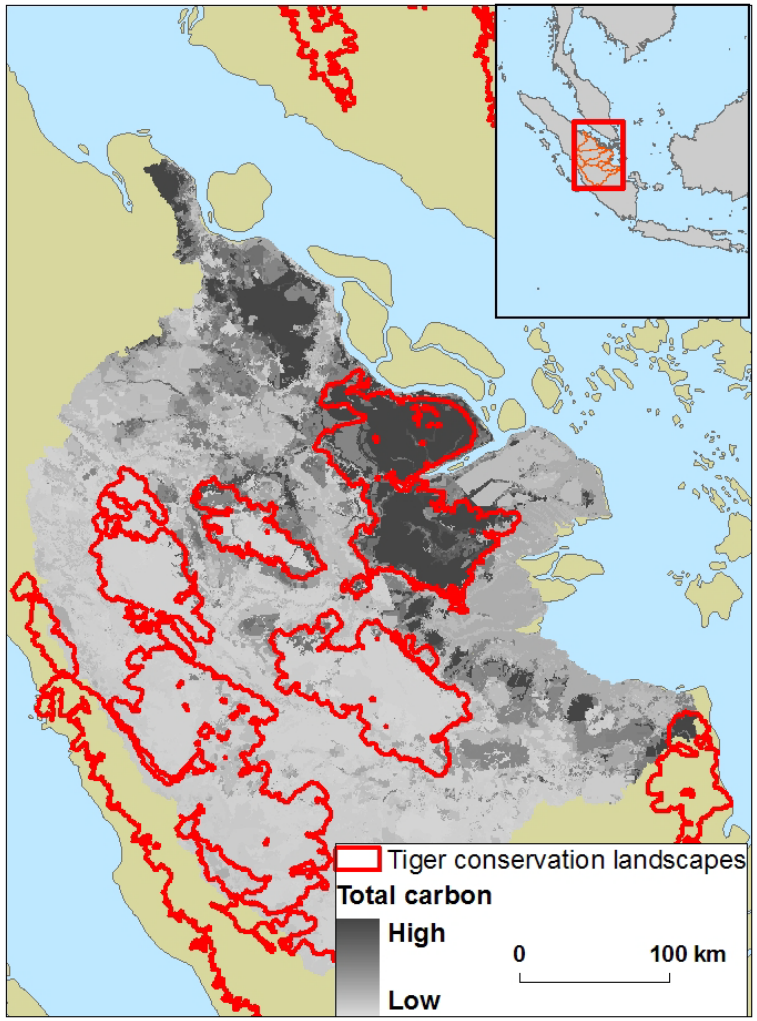


Sediment retention

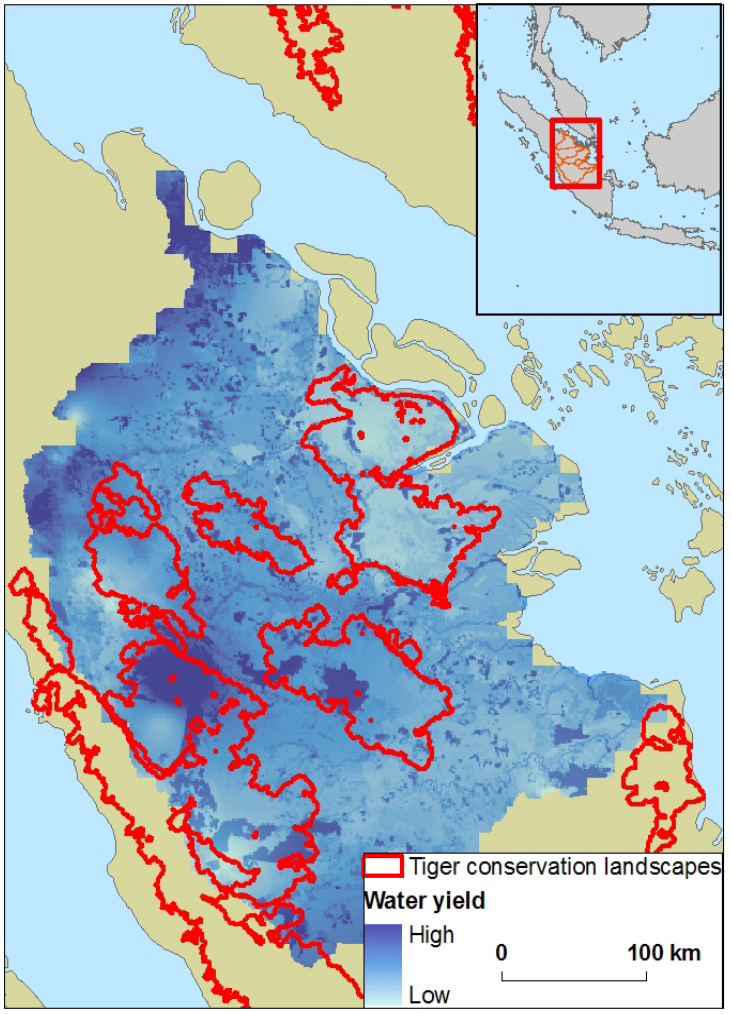


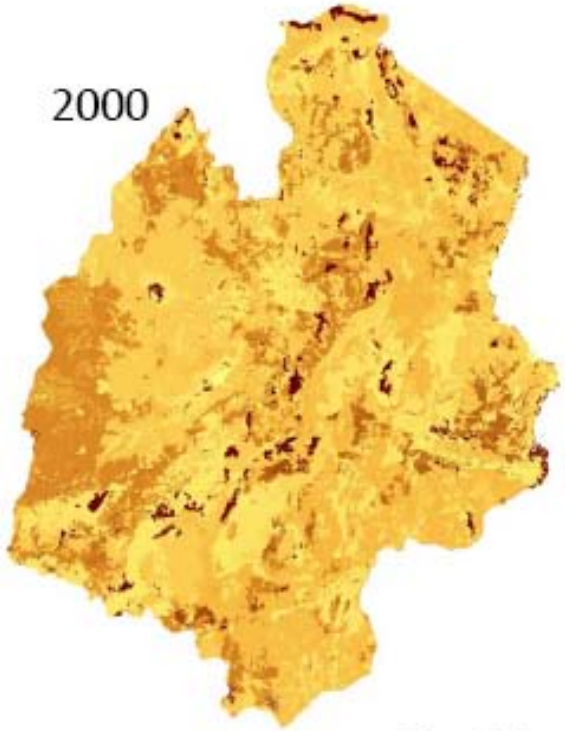
Comparison with tiger priority areas

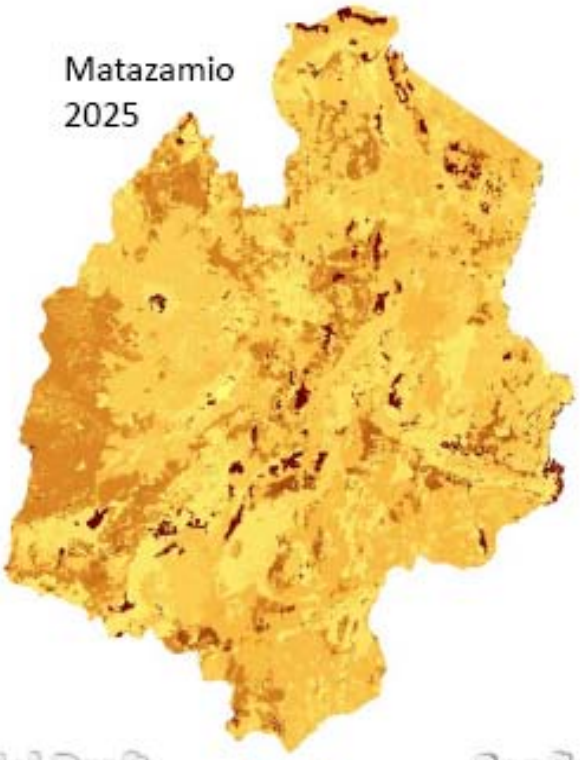
Carbon

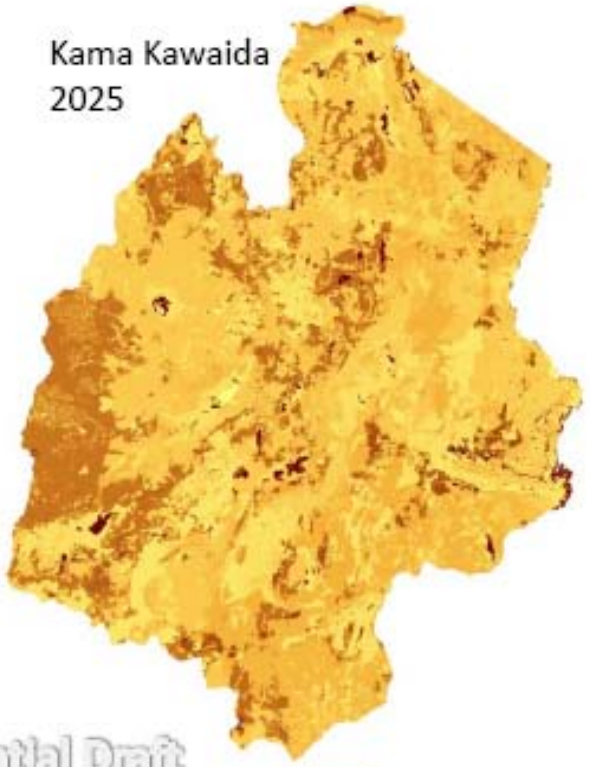


Water yield









2.86^{9} t/C
2,864,239,183 t/C

LOSS

-3.26^{7} t/C
or **-1.14%** of 2000 value

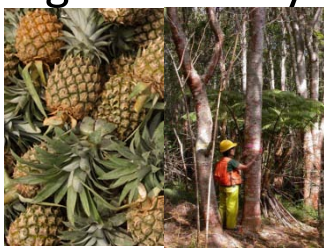
LOSS

-18.27^{7} t/C
or **- 6.38%** of 2000 value

natural capital PROJECT

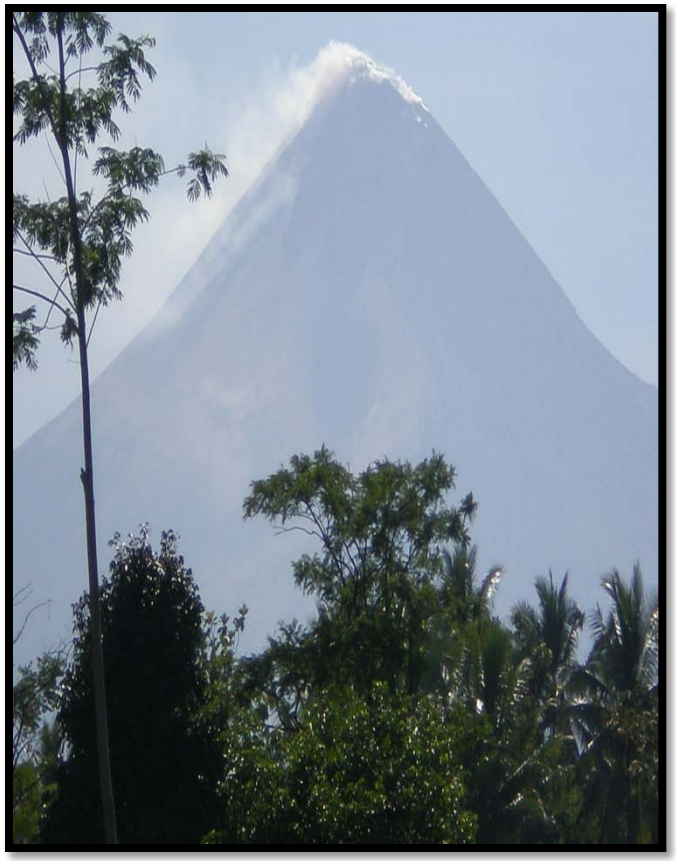
VALUING THE ARC

InVEST results: Hawaii

	Carbon Storage	Water Quality	Water Yield	Income
Biofuels 	↓	↓	↓	↑
Subdivision 	↓	↓	↑	↑
Ag & Forestry 	↑	↑	↓	↑

Another approach: Single service models

- Examples
  - SWAT and FIESTA for water yield
  - ClassLite for carbon
  - Real-time monitoring tools
- Advantages
  - Technically sophisticated
  - Established and peer reviewed
- Disadvantages
  - Data demanding
  - Not integrated into one tool



Other approaches: ARIES

- Assess and value ecosystem services
  - Artificial intelligence turns user input into causal model
  - Learns from relevant data and constructs cause-and-effect interactions
  - Simple or complex approaches possible
  - Scenario based

CONSERVATION INTERNATIONAL
people need nature to thrive

The University of Vermont

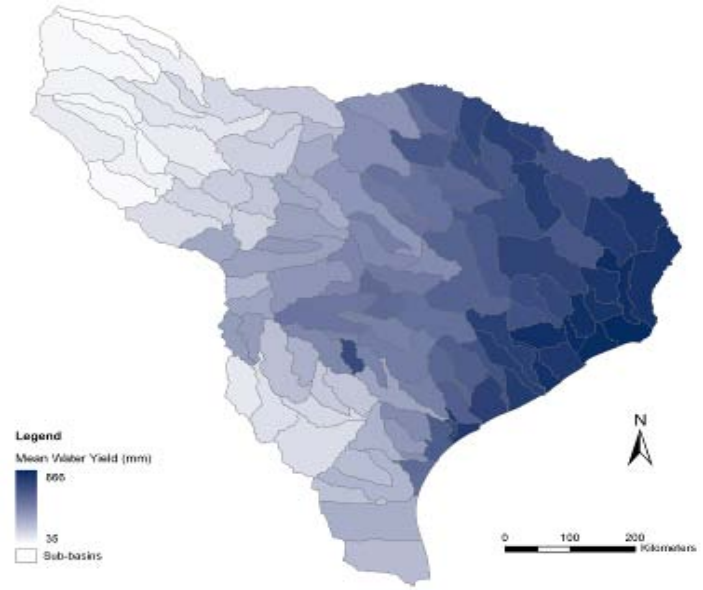
EARTH ECONOMICS

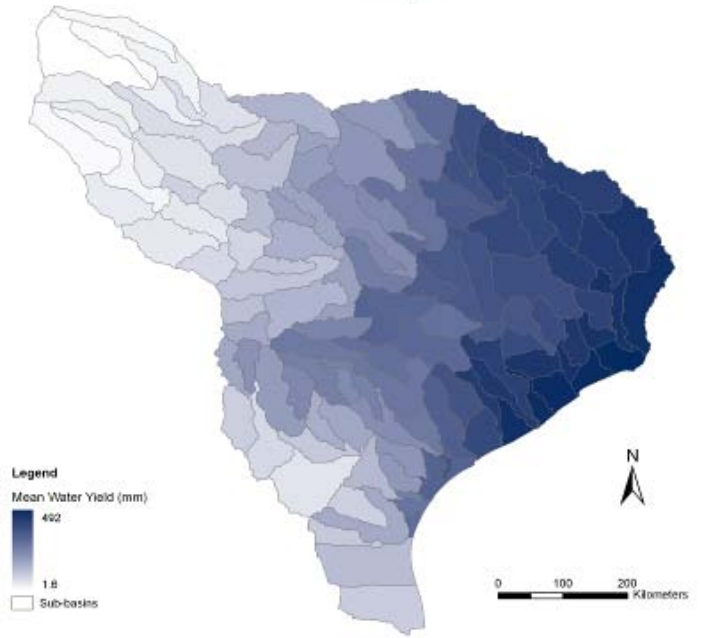
InVEST	ARIES
Deterministic models	Probabilistic models
ArcGIS interface	Web-based, customisable
Working on uncertainty	Fully probabilistic outputs
Standard models can be customised by user	Machine learning customises models
No use of benefits transfer. Standard econ valuation methods	Benefits transfer & multi-criteria approach to valuation
Simple ‘proxy’ for biodiversity	Overlay with IBAT information
Version 1.004 available online	Version 1.0 available later in 2010
User must collect data	Internal database

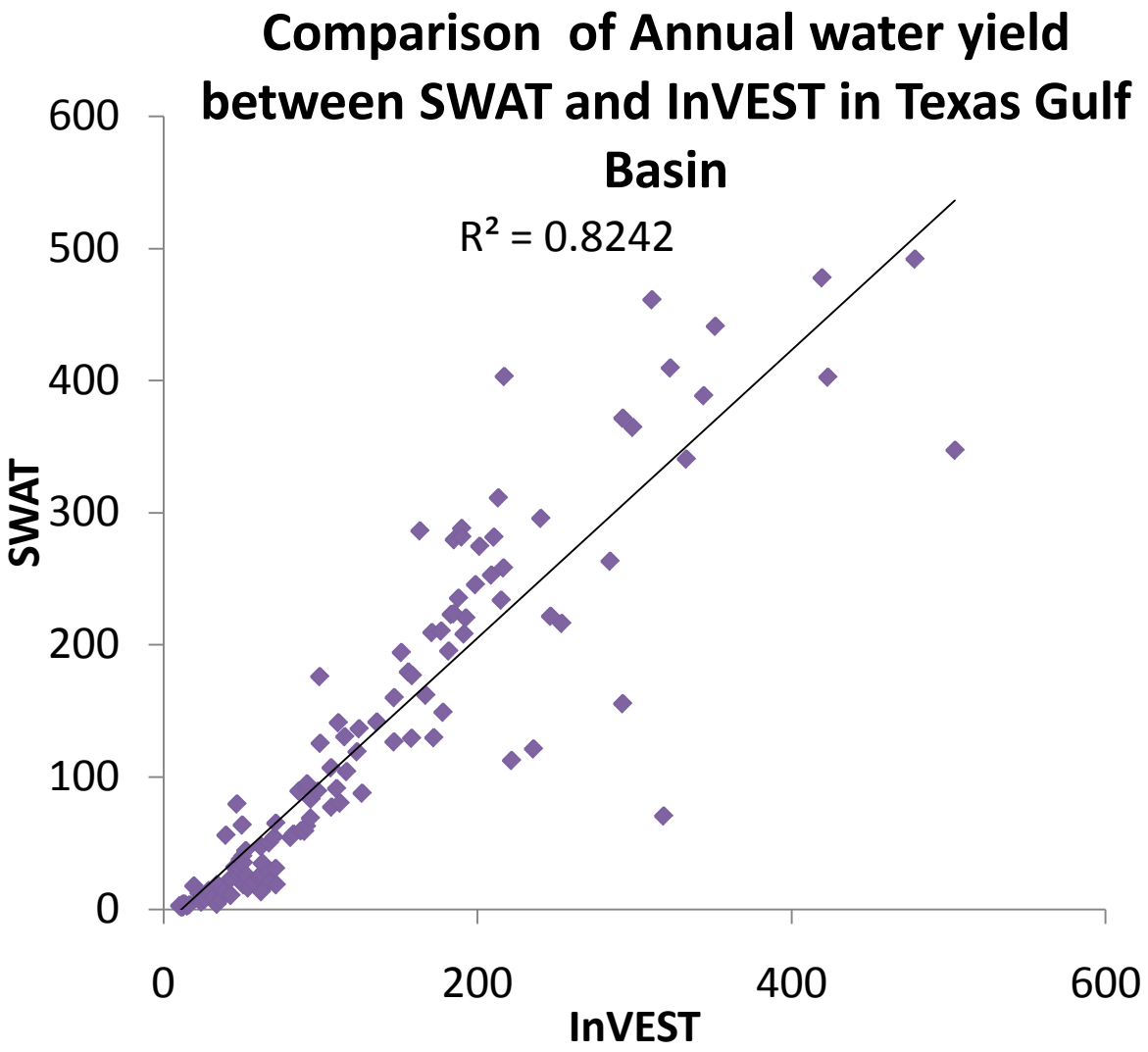
InVEST testing and validation

- Testing against SWAT and FIESTA
  - Colombia and Ecuador

- Comparing with ARIES
  - Arizona and Oregon
- Ground-truthing
  - China: water yield model explains > 90% of observed
  - Minnesota: water pollution model only 9% off observed


Legend
Mean Water Yield (mm)
665
35
Sub-basins
N
0
100
200
Kilometers


Legend
Mean Water Yield (mm)
492
1.8
Sub-basins
N
0
100
200
Kilometers


Comparison of Annual water yield between SWAT and InVEST in Texas Gulf Basin
R² = 0.8242
SWAT
InVEST
600
500
400
300
200
100
0
0
200
400
600

Emerging areas for NatCap

- Marine InVEST
- InVEST adjustments
  - Scenario generator
  - Uncertainty
  - Tier 2 models
- Health
  - Nutrition
  - Infectious diseases
- Distribution and equity
  - Who gains and who loses?

Questions for discussion

- Initial reactions?
- How can emerging tools contribute to REDD+?
- What else should tools be able to do?

THANK YOU!