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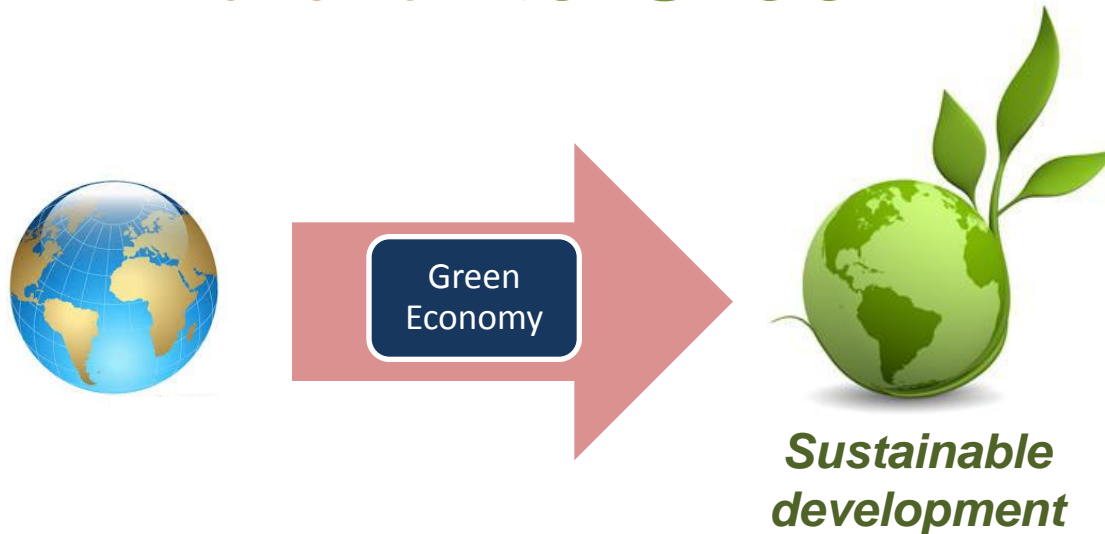
# Building the Green Economy with Sovereign Wealth Funds

**Raul Martinez Oviedo and Francesca Medda**

# Outline

- Context
- Objectives
- Model and data
- SWFs investing in natural capital
- Conclusions

# Transition to Green



**9 billion**

World population by 2050

**\$83bn**

Investment needed to meet agricultural needs in 2050

**\$4.7tn**

Current annual cost of environmental degradation to the global economy

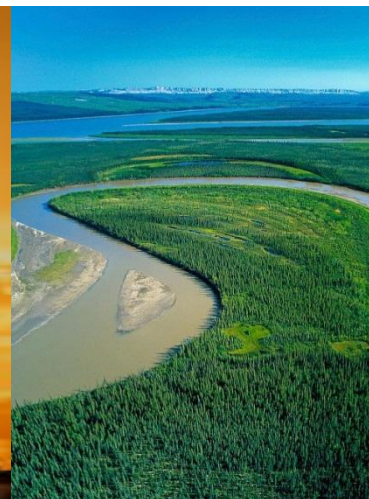
**80%**

GHG emissions reduction target set by EU in 2050 (1990 baseline)



# Natural Capital

- Non-renewable | Recoverable | Ecosystem services
- Declining value relatively to other forms of capital
- Can **Sovereign Wealth Funds (SWF's)** play any role?  
Recovering its value is essential



Context

Objectives

Model & data

Results

Conclusions

## Previous work

### SWFs

Rise of SWFs, Investment strategies,  
Portfolio optimization, Performance

Bernstein et al. (2013)  
Nie et al. (2012)  
Mikita (2012)  
Dyck and Morse (2011)  
Jory et al. (2010)

### Natural Capital

Importance, Need of investments,  
Depreciation, Economic impact

Barbier (2014)  
UNEP (2014)  
NCC (2014)  
ten Brink et al. (2012)  
Dasgupta (2010)

# Objectives

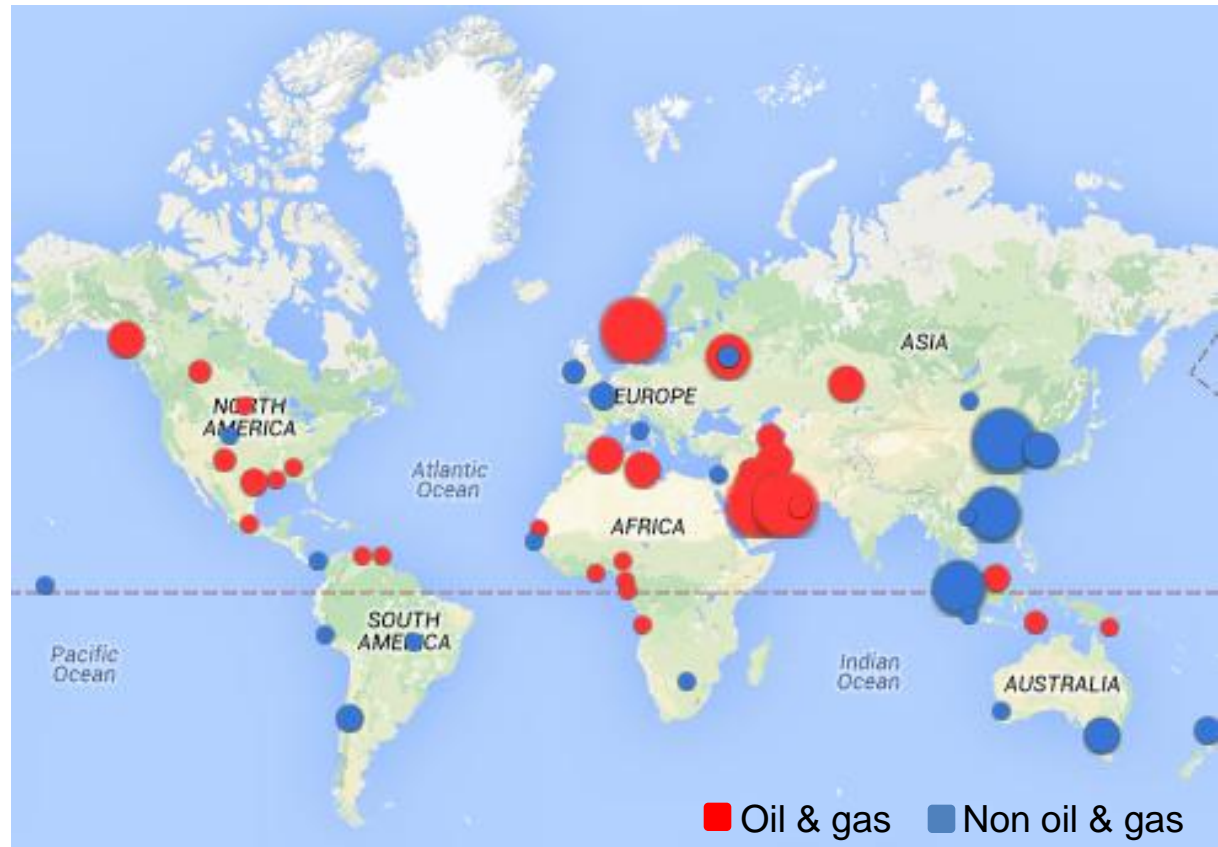
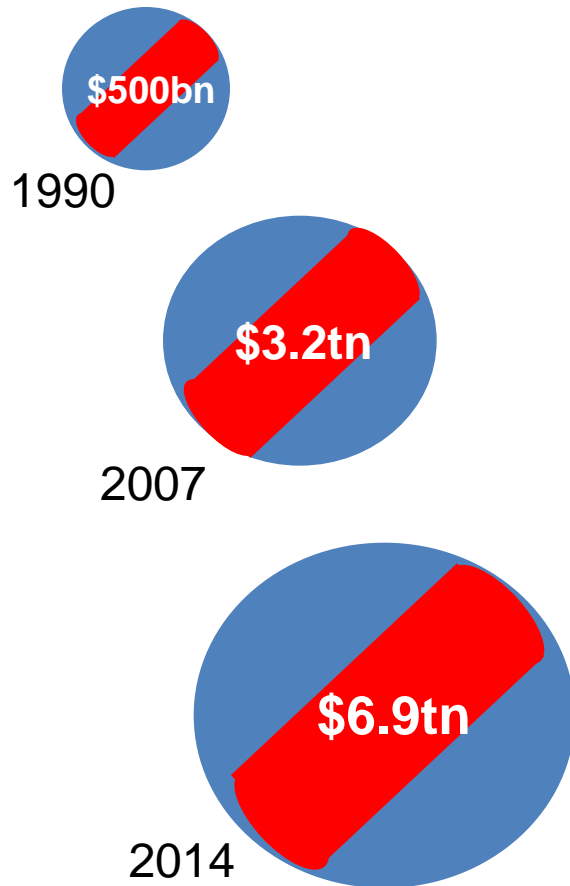
- 1 To study the financial benefits of investing in Natural Capital
- 2 To evaluate the performance of SWFs investing in Natural Capital
- 3 To understand the role that SWFs can play as investors in Natural Capital

# Why Sovereign Wealth Funds?



# ✓ Global players of increasing importance

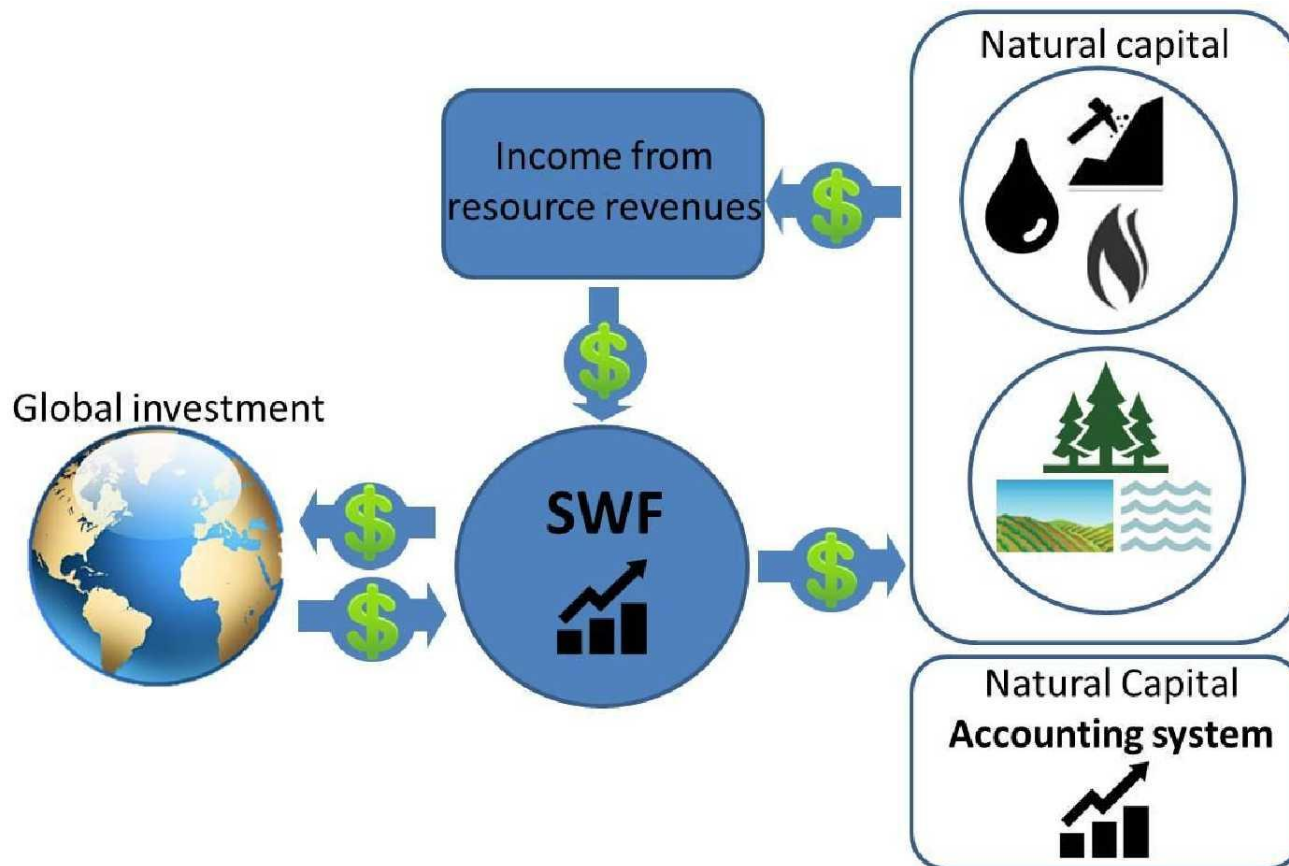
## Total assets under management



(Sovereign Wealth Fund Institute, 2014)



- ✓ Suitable to preserve the value of Natural Capital



# ✓ The context: SWFs are seeking for long-term investments



“ We are keen to invest more across the entire value chain [agriculture sector] in areas that will help to unlock the industry’s potential, increase the food supply and offer attractive returns ”

Ding Xuedong,  
Chief Executive of China Investment Corp (2014)



“ [Timberland] is an asset class that is growing among public sector. Sovereign Wealth Funds like the New Zealand Superannuation Fund and Canada’s Alberta Heritage Fund are investors in timberland investments ”

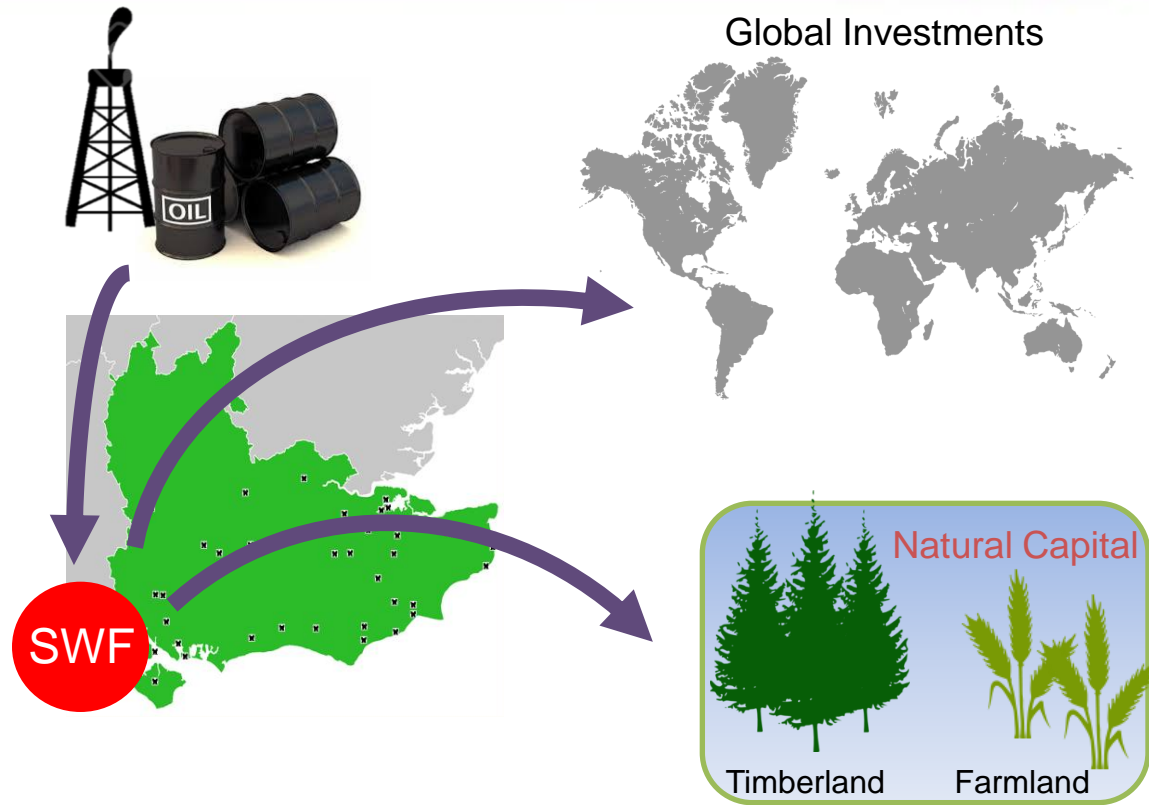
Sovereign Wealth Fund Institute Asset Allocation Report (2012)



“ Almost everyone with talk to says this is an asset class [farmland] they can invest in... The sector is attracting insurance companies and Sovereign Wealth Funds ”

Berry Polmann,  
Head of Real Assets at ADVEQ (2013)

# The model



- Portfolio of investment of a SWF
- 10-years period (2004-2014)
- 3 scenarios: Pre-crisis | During Crisis | Post Crisis
- Measuring performance of investments

Fund's size



$$M_t = M_{t-1} + (\alpha_t - C_t)$$

Management cost

## The model

$$C_t \sim UD[c_{\min}, c_{\max}]$$

Oil revenues

Allocations variables

$$\alpha_t = \gamma e_t p_t + x_t (a \omega_t^T \hat{\mathbf{r}}_t + b \omega_t^T \tilde{\mathbf{r}}_t + c \omega_t^T \bar{\mathbf{r}}_t + d \omega_t^T \dot{\mathbf{r}}_t)$$

$$a + b + c + d = 1, \quad \omega = (w_1, w_2, \dots, w_m)$$

Markowitz portfolio optimization

$$\omega = \arg \min_{\mathbf{w}} \mathbf{w}^T \sigma \mathbf{w} \quad \text{subject to} \quad \mathbf{w}^T \mathbf{r} = r', \quad \sum_{i=1}^m w_i = 1$$

Variable	Description	Descriptive statistics				Type
		(%) Mean	(%) Volatility	(%) Min	(%) Max	
Equity						
Basic Materials North America	Dow Jones US Basic Materials Index	1.70	15.79	-72.13	40.12	Quarterly
Basic Materials Europe	STOXX EUR 600 Basic Materials Index	2.52	18.07	-77.11	41.36	Quarterly
Basic Materials Asia	Thomson Reuters Asia/Pacific Basic Materials Index	1.20	14.88	-55.03	40.38	Quarterly
Consumer Goods North America	Dow Jones US Consumer Goods Index	1.78	7.13	-23.15	17.30	Quarterly
Consumer Goods Europe	STOXX EUR 600 Consumer Goods Index	2.81	9.93	-55.03	21.80	Quarterly
Consumer Goods Asia	Dow Jones Asia/Pacific Consumer Goods Index	1.27	9.68	-39.04	25.35	Quarterly
Consumer Services North America	Dow Jones US Consumer Services Index	2.16	9.49	-36.78	20.78	Quarterly
Consumer Services Europe	STOXX EUR Consumer Services Index	0.84	7.73	-19.13	13.92	Quarterly
Consumer Services Asia	Dow Jones Asia/Pacific Consumer Services Index	1.33	7.79	-22.62	19.37	Quarterly
Energy North America	Thomson Reuters US Energy Index	2.31	11.92	-36.37	22.03	Quarterly
Energy Europe	Thomson Reuters EUR Energy Index	0.87	12.12	-36.25	25.28	Quarterly
Energy Asia	Dow Jones Asia/Pacific Oil&Gas Index	2.02	15.13	-60.57	37.05	Quarterly
Financial North America	Dow Jones US Financial Services Index	0.30	15.02	-56.99	40.83	Quarterly
Financial Europe	STOXX EUR 600 Financial Services Index	1.56	16.79	-58.79	45.16	Quarterly
Financial Asia	Thomson Reuters Asia/Pacific Financial Services Index	1.60	30.25	-101.08	78.93	Quarterly
Health Care North America	Dow Jones US Health Care Index	2.05	7.77	-28.12	12.06	Quarterly
Health Care Europe	STOXX EUR 600 Health Care Index	2.53	8.25	-26.13	15.66	Quarterly
Health Care Asia	MSCI All country Asia/Pacific Health Care Index	1.45	7.12	-22.03	13.30	Quarterly
Industrial North America	Dow Jones US Industrial Index	1.86	12.01	-44.82	27.48	Quarterly
Industrial Europe	STOXX 600 Industrial Index	2.49	14.49	-58.65	29.04	Quarterly
Industrial Asia	Dow Jones Asia/Pacific Industrial Index	1.27	12.43	-45.48	36.17	Quarterly
Technology North America	Dow Jones US Technology Index	2.12	11.52	-45.78	25.65	Quarterly
Technology Europe	STOXX 600 Technology Index	1.00	14.45	-58.18	33.88	Quarterly
Technology Asia	Thomson Reuters Asia/Pacific Technology Index	1.38	13.07	-53.19	38.23	Quarterly
Utility North America	Dow Jones US Utility Index	1.40	7.42	-24.81	9.30	Quarterly
Utility Europe	STOXX 600 Technology Index	0.93	12.47	-42.03	19.70	Quarterly
Utility Asia	Thomson Reuters Asia/Pacific Utilities Index	0.59	7.25	-22.51	12.60	Quarterly
Telecommunications North America	Dow Jones US Telecom Sector Index	0.77	8.16	-20.77	12.57	Quarterly
Telecommunications Europe	STOXX EUR 600 Telecom Index	0.83	11.01	-25.98	19.98	Quarterly
Telecommunications Asia	Thomson Reuters Asia/Pacific Technology Index	1.86	6.93	-15.92	13.19	Quarterly
Equities overall Latin America	MSCI Latin America Price Index	2.66	17.65	-67.05	43.88	Quarterly
Real Estate						
North America	Thomson Reuters US Property Index	1.57	8.10	-26.34	15.01	Quarterly
UK	Thomson Reuters UK Property Index	0.52	13.81	-47.84	27.30	Quarterly
Europe ex. UK	Thomson Reuters Europe (ex. UK) Index	1.93	15.79	-64.76	31.12	Quarterly
Asia	Thomson Reuters Asia Property Index	1.22	11.07	-34.90	25.33	Quarterly
Fixed-income						
North America	Barclay's Capital US Aggregated Bond Index	1.16	1.45	-1.93	3.90	Quarterly
Natural Capital						
Timberland	NCREIF Timberland Property Index	2.09	2.97	-4.55	11.98	Quarterly
Farmland	NCREIF Farmland Index	4.26	4.46	0.67	22.78	Quarterly



# Data

- WTI – FOB monthly prices (2004-2014)
- Oil exports 1.5 mbd
- 15% of revenues allocated to the SWF



# Data



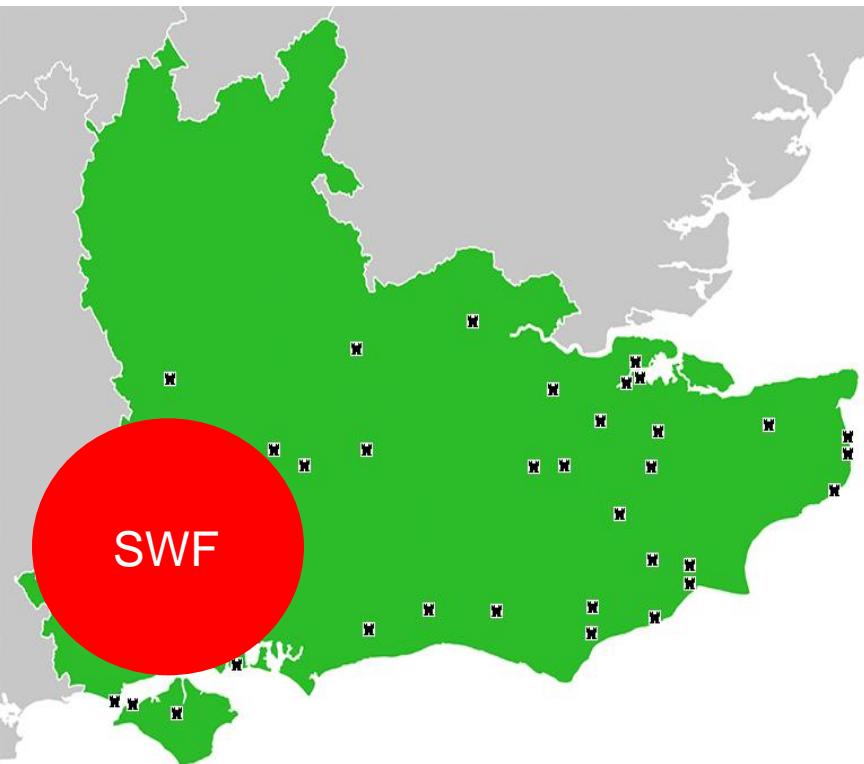
- Equity
  - 10 sectors | Monthly data | US, Europe, Asia & Latin America
- Real Estate
  - US, UK, Europe, Asia | Monthly data
- Fixed-income
  - US market | Monthly data
- Indexes used: Dow Jones, STOXX, Thomson Reuters, Barclay's Capital

# Data

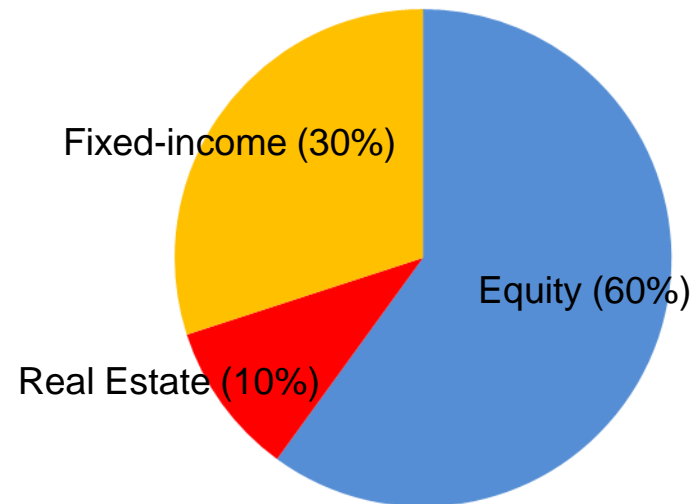
- Sustainable Timberland & Sustainable Farmland
- NCREIF Timberland Index | Farmland Index
- Quarterly returns (US market)



## Data



- Initial fund size \$10bn
- Management cost \$15-35mn
- Natural Capital allocation 0-20%
- Baseline portfolio



# Results (Quarterly basis)

	Pre-crisis (Jun 04 – Sep 07)				During-crisis (Jun 07 – Sep 10)				Post-crisis (Dec 10 - Mar 14)			
	Mean (%)	Volatility (%)	Min (%)	Max (%)	Mean (%)	Volatility (%)	Min (%)	Max (%)	Mean (%)	Volatility (%)	Min (%)	Max (%)
Timberland	3.66	3.04	0.85	11.98	1.60	3.28	-4.55	9.38	1.37	2.10	-0.79	5.92
Farmland	5.70	6.55	0.74	22.78	2.77	2.39	0.67	7.92	4.43	3.01	1.48	9.56
Agt. Equity	4.66	6.60	-7.18	15.08	-1.56	15.08	-28.65	21.21	1.31	8.80	-18.35	13.98
Agt. Real Estate	3.66	7.90	-12.60	15.24	-3.24	15.97	-28.66	24.31	2.23	7.95	-17.68	12.23
Fixed-income	1.10	1.51	-1.39	3.43	1.87	1.70	-1.03	4.48	0.88	1.49	-2.35	3.75

Natural Capital shows relative high return and low volatility!



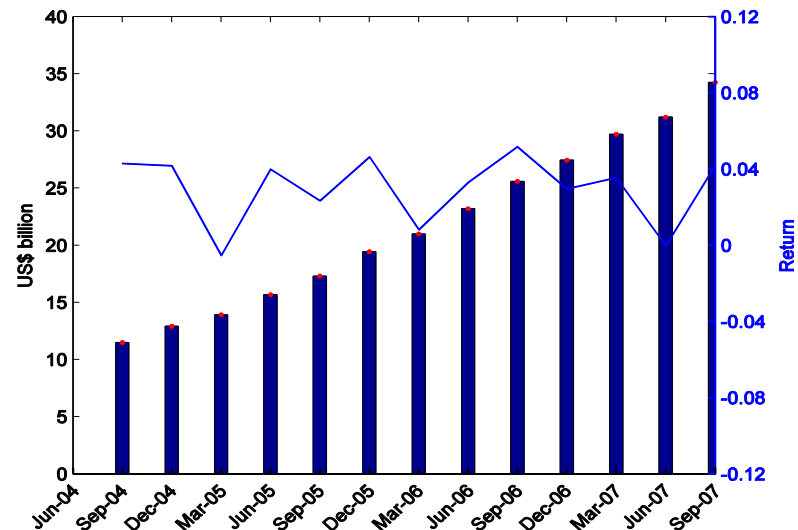
# Performance of the baseline portfolio (Quarterly basis)

Scenario 1: Pre-crisis period (Jun 04 – Sep 07)

Return **2.98 %**

Volatility **1.83 %**

Growth **198.2 %**



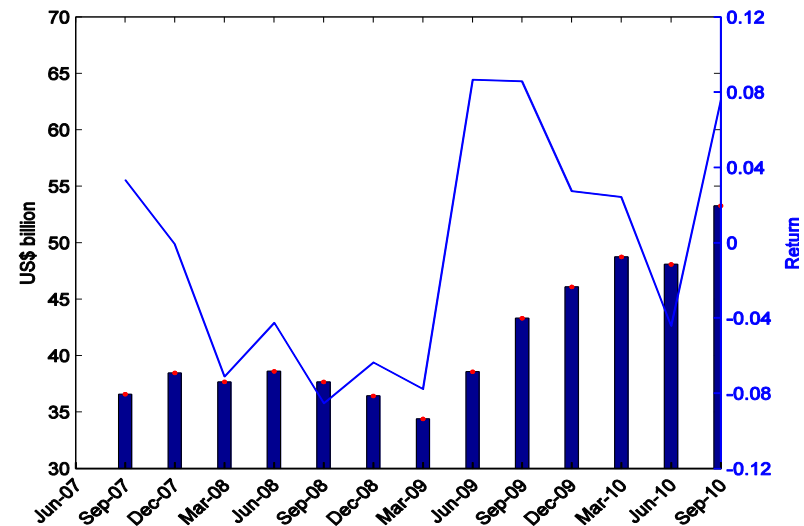
# Performance of the baseline portfolio (Quarterly basis)

Scenario 2: During-crisis period (Jun 07 – Sep 10)

Return **-0.4 %**

Volatility **6.39 %**

Growth **45.6 %**



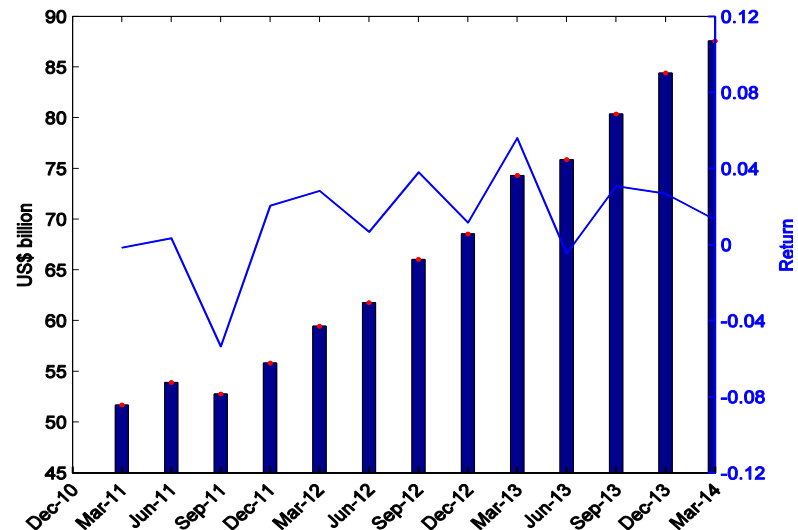
# Performance of the baseline portfolio (Quarterly basis)

Scenario 3: Post-crisis period (Dec 10 – Mar 14)

Return **1.35 %**

Volatility **2.64 %**

Growth **69.4 %**



# Effect of including Natural Capital

(Quarterly basis)

	3% Natural Capital			5% Natural Capital			10% Natural Capital		
	Pre	During	Post	Pre	During	Post	Pre	During	Post
<b>Return (%)</b>	3.01	-0.26	1.36	3.02	-0.17	1.37	3.09	-0.03	1.40
<b>Volatility (%)</b>	1.76	6.04	2.52	1.72	5.80	2.44	1.67	5.32	2.30
<b>Growth (%)</b>	199.5	47.62	69.53	200.42	48.95	69.6	203.04	51.7	70.05

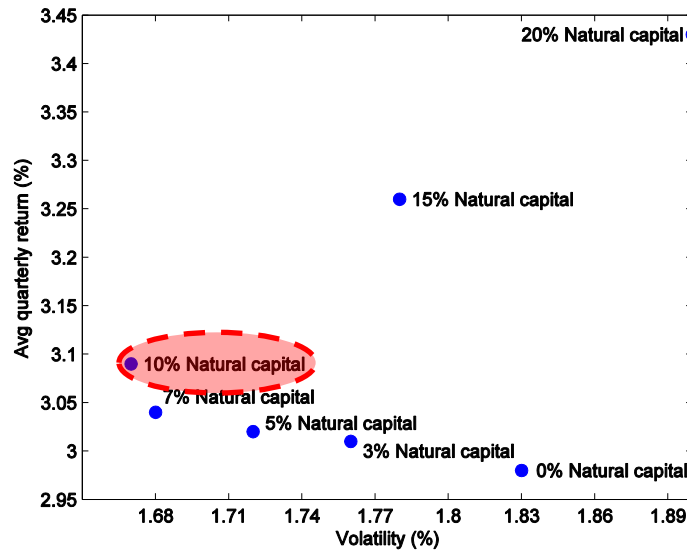
# Effect of including Natural Capital

(Quarterly basis)

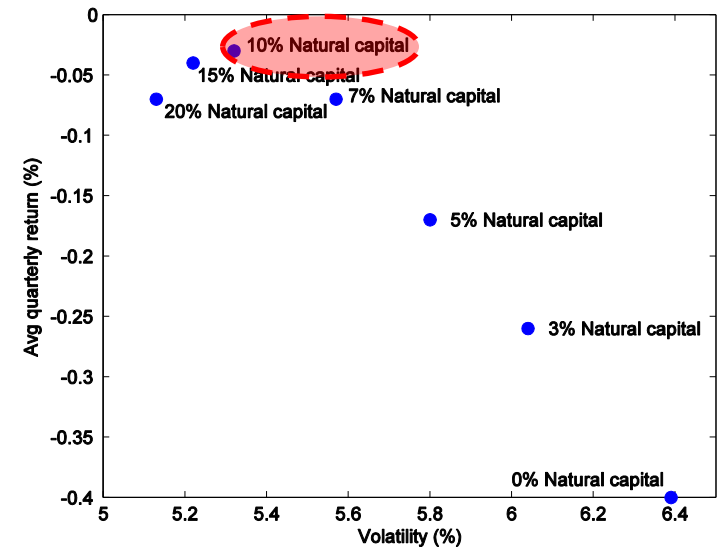
	3% Natural Capital			5% Natural Capital			10% Natural Capital		
	Pre	During	Post	Pre	During	Post	Pre	During	Post
<b>Δ Return (%)</b>	↑ 0.03	↑ 0.14	↑ 0.01	↑ 0.04	↑ 0.23	↑ 0.02	↑ 0.11	↑ 0.37	↑ 0.05
<b>Δ Volatility (%)</b>	↓ 0.07	↓ 0.35	↓ 0.12	↓ 0.11	↓ 0.59	↓ 0.2	↓ 0.16	↓ 1.07	↓ 0.34
<b>Δ Growth (%)</b>	↑ 1.35	↑ 1.99	↑ 0.1	↑ 2.2	↑ 3.4	↑ 0.2	↑ 4.8	↑ 6.1	↑ 0.7



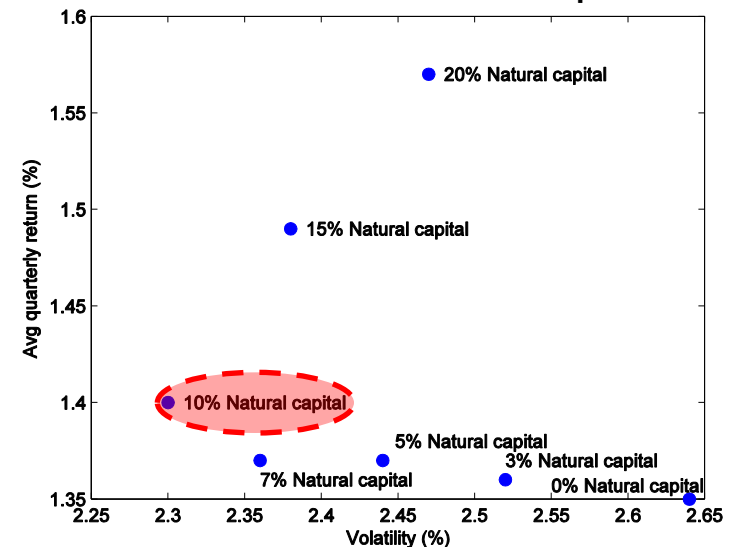
## Scenario 1: Pre-crisis period



## Scenario 2: During-crisis period



## Scenario 3: Post-crisis period



## Investing in natural capital

- ✓ Best results found at 10 %
- ✓ Most investors allocate 1-5 %

# Conclusions

- 1 Financial benefits for SWFs go beyond just inflation proofing
- 2 SWFs can improve their performance when investing in natural capital
- 3 SWFs may be suitable instruments to preserve natural capital's value

# Limitations

- Past performance is not guarantee of future results
- Natural capital is limited to Timberland & Farmland
- NCREIF Indexes represent the US market only

תודה  
 Dankie Gracias  
 Спасибо  
 شكرًا  
 Merci Takk  
 Köszönjük Terima kasih  
 Grazie Dziękujemy Děkojame  
 Ďakujeme Vielen Dank Paldies  
 Kiitos Tänname teid 谢谢  
**Thank You** Tak  
 感謝您 Obrigado Teşekkür Ederiz  
 Σας Ευχαριστούμ 감사합니다  
 Bedankt បទបញ្ជា  
 Děkujeme vám  
 ありがとうございます  
 Tack



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