Valuing Changes to Ecosystem Services from Gas and Mineral Development

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ACES 2016
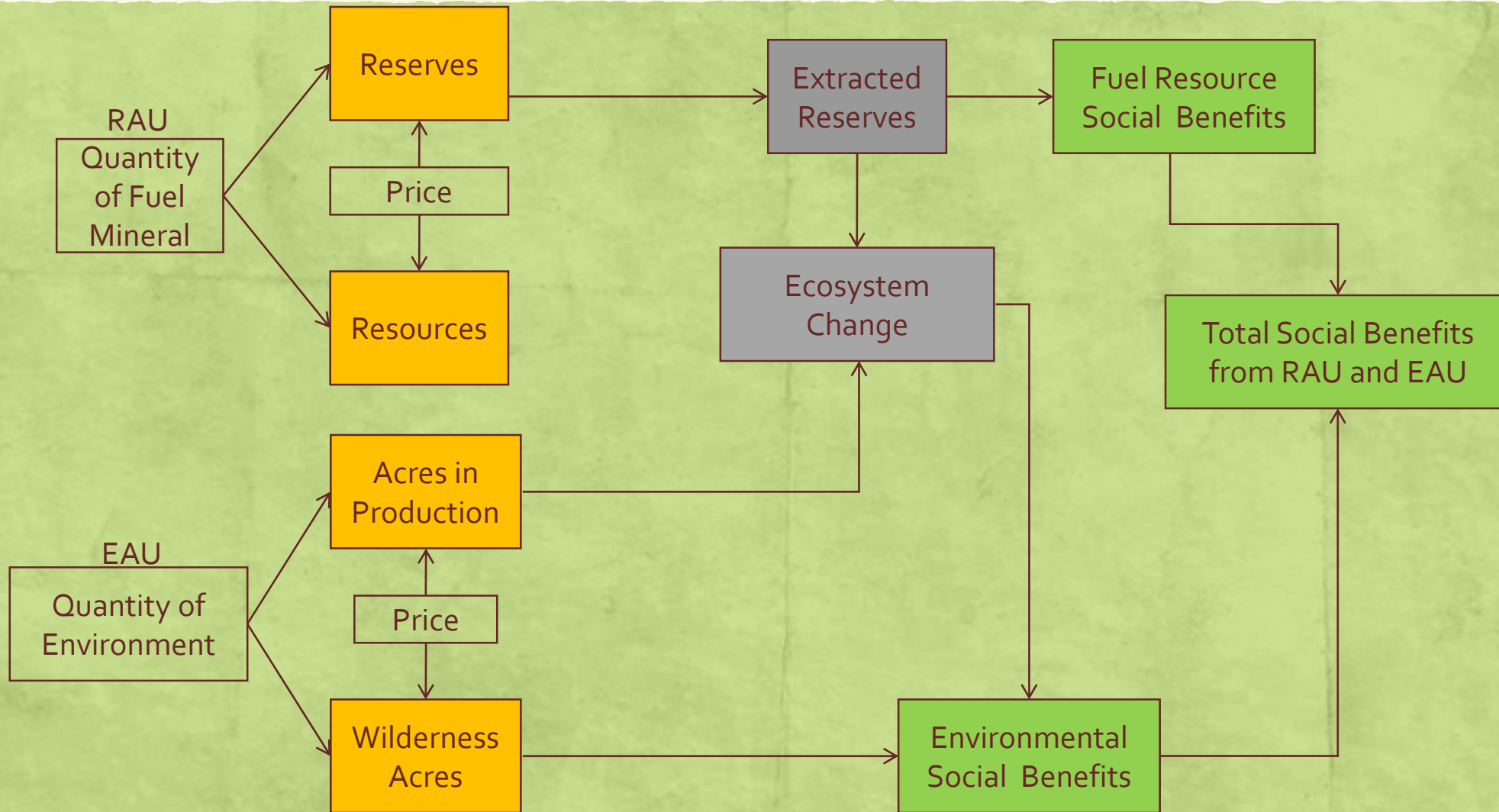
Introduction

- Land Decisions and Impacts
  - Fuel and mineral resource extraction
  - Ecosystem services / fragmented habitat

Introduction (Simple Framework)

Ecosystem Services

- "The benefits of nature to households, communities, and economies."

  Daily 1997

- "Final ecosystem services are components of nature, directly enjoyed, consumed, or used to yield human well being."

  Boyd and Banzhaf 2007

Environmental / Ecosystem Valuation

- Revealed Preference
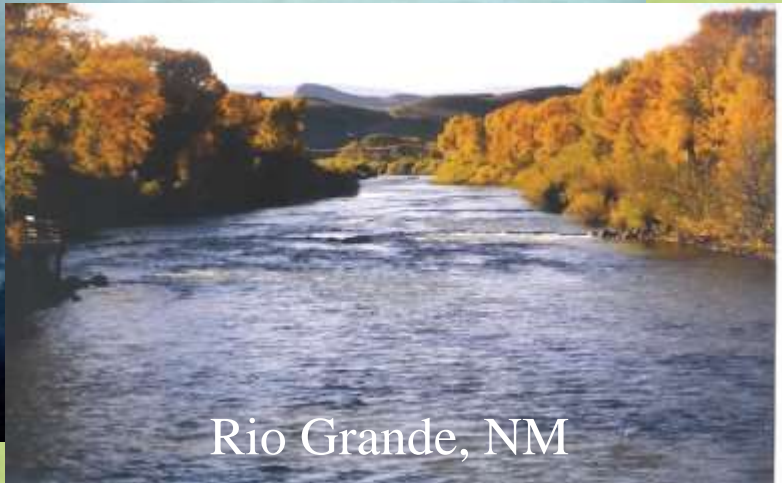 - Travel Cost Model
  - Hedonic Pricing Model

4 Bedrooms, 2.5 Bath $3,695,000

A $3,000,000 View!

3 Bedrooms, 2 Bath $740,000

Environmental / Ecosystem Valuation

- Stated Preference
  - Contingent Valuation (CV)
    - Hypothetical questions to elicit WTP or WTA
  - Choice Experiments (CE)
    - Choose a specific alternative from a set of alternatives
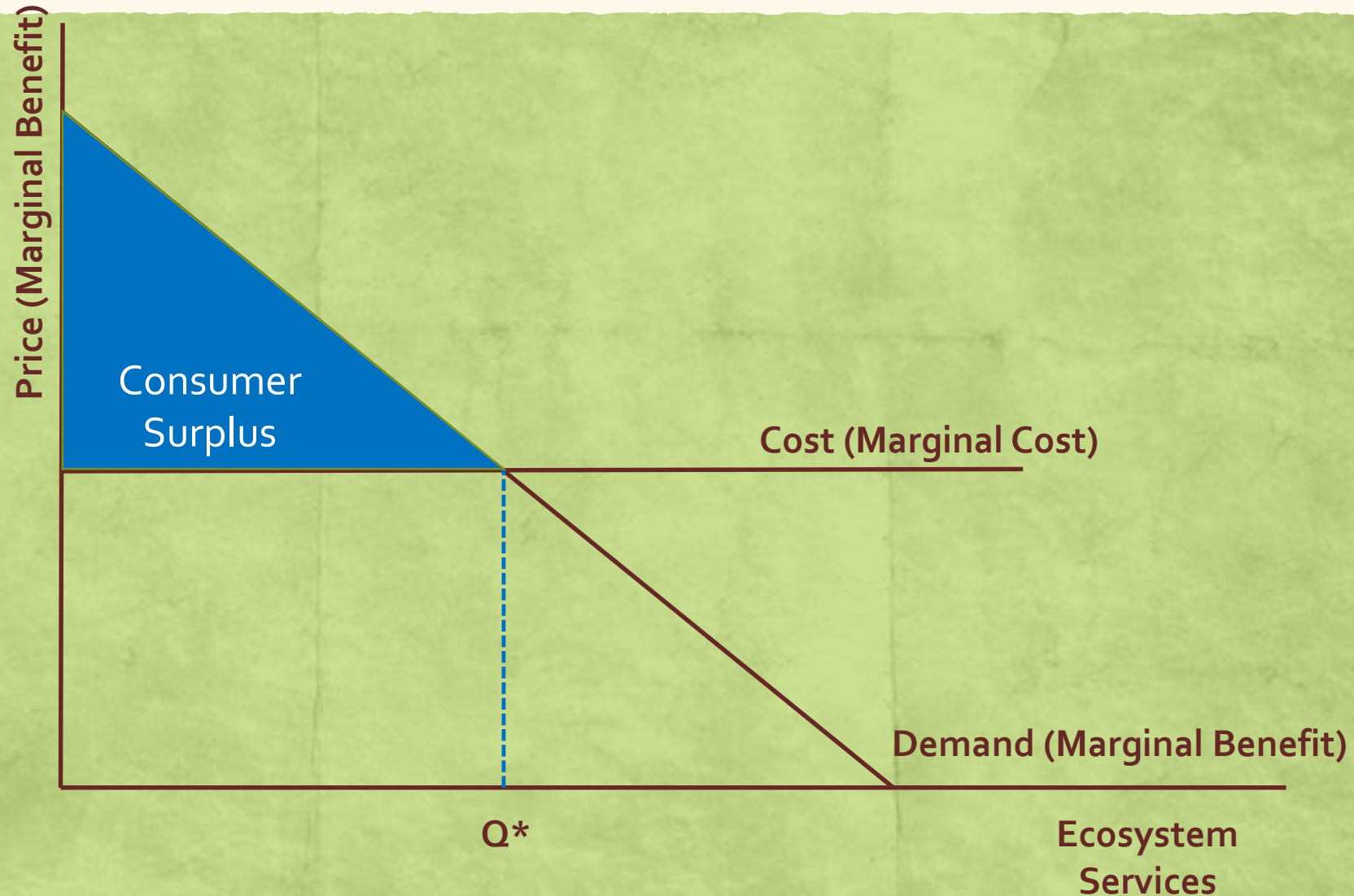
Rio Grande, NM

San Pedro River, AZ

Valuing Ecosystem Services

- Consumer Surplus – economic measure of consumer benefit that measures the difference between what a consumer is willing and able to pay and what they have to pay.

Price (Marginal Benefit)

Consumer Surplus

Cost (Marginal Cost)

Demand (Marginal Benefit)

Q*

Ecosystem Services

Environmental Externalities

- Production Externalities – costs of production that are not born by the producer.

- Social Cost of Resource Extraction – Loss in Ecosystem Services
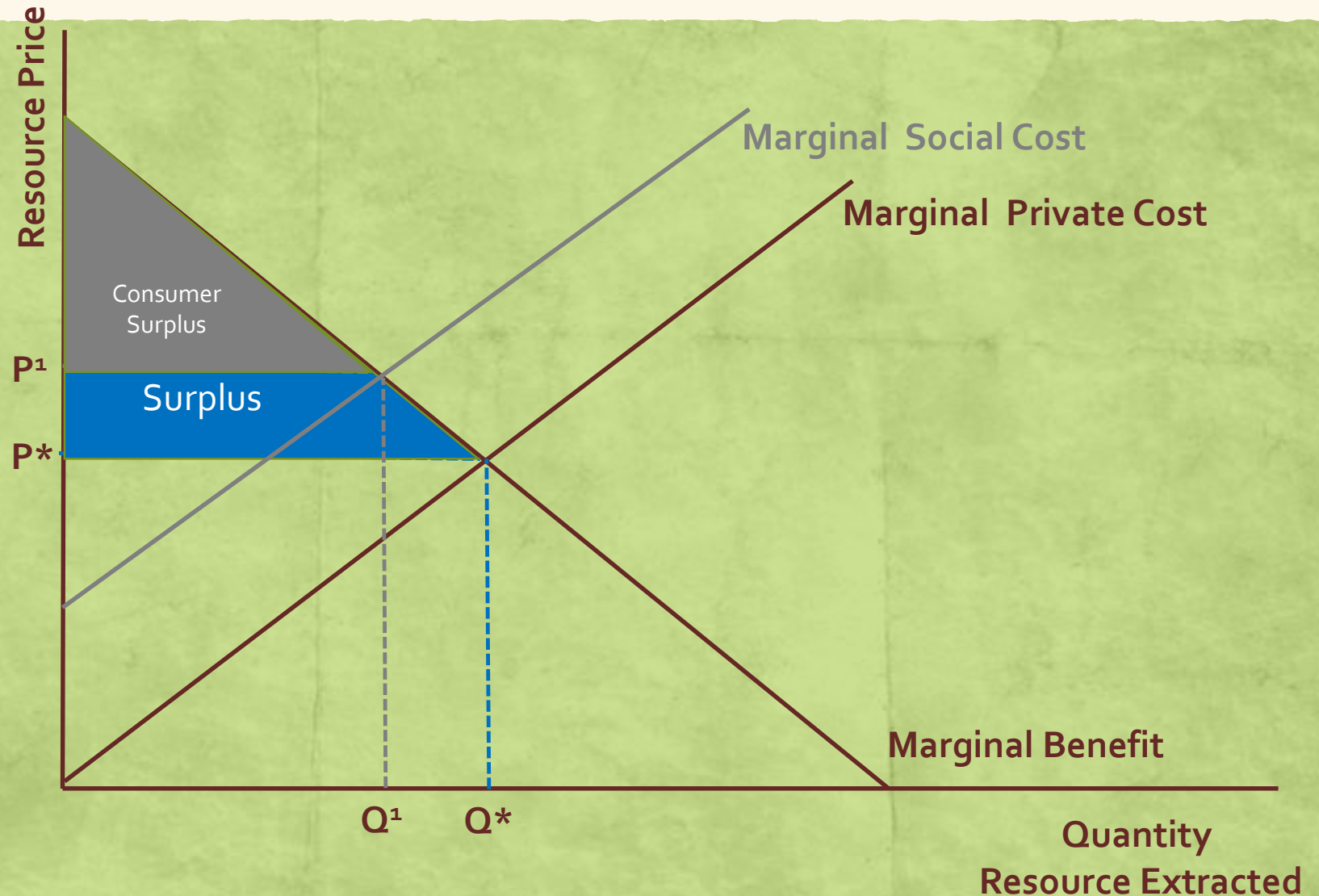
Perpetual Loss in Ecosystems
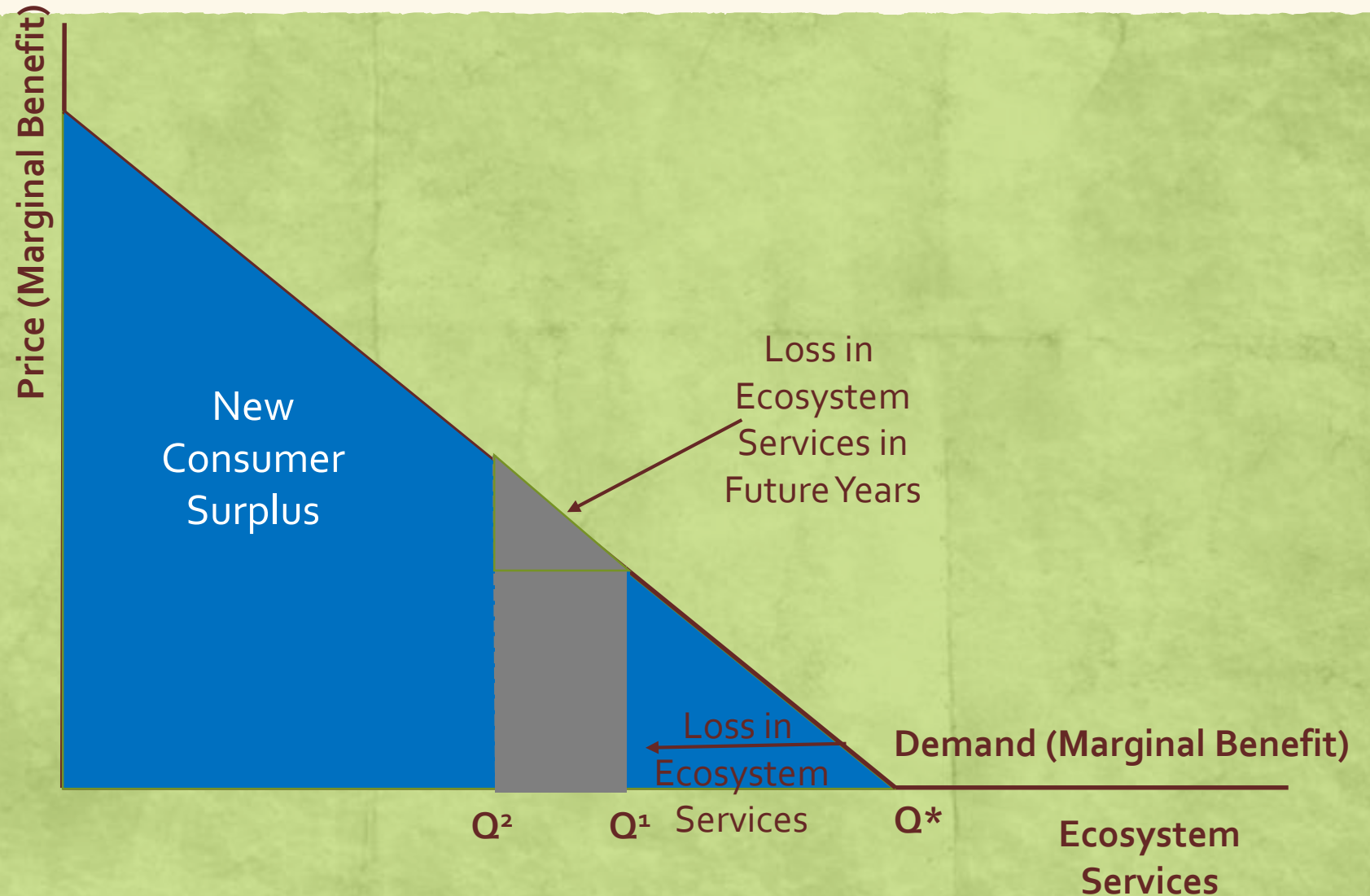
- Loss in ecosystem services:
  - Stems from development
  - Results in a loss in consumer surplus (i.e. consumer benefits)
  - An increase in social costs

Obtaining Consumer Surplus

- Meta-Analysis of Environmental Valuation Studies from Rosenberger

$$Consumer\ Surplus = \beta_0 + \beta_1\left(Species\ Type\right) + \beta_2\left(U.S.\ Region\right) + B_3\left(Good\ Type\right)$$
$$+ \beta_4\left(Decade\right) + \beta_5\left(Multi-regression\right) + \beta_6\left(Sample\ Size\right)$$
$$+ \beta_7\left(Response\ Rate\right) + \beta_8\left(Valuation\ Method\right) + \varepsilon_i$$

Sample Statistics (meta)

	Regressor	Observations	Mean	Standard Deviation
Species Type	Big Game	1015	0.149	0.356
	Small Game	1015	0.024	0.152
	Freshwater Fish	1015	0.281	0.450
	Saltwater Fish	1015	0.037	0.190
	Wildlife Viewing	1015	0.090	0.286
	Waterfowl	1015	0.023	0.149
U.S. Region	Northeast	1015	0.486	0.500
	Midwest	1015	0.115	0.320
	West	1015	0.159	0.366
	South	1015	0.201	0.401
	Mulit-Region	1015	0.902	0.297
Good Type	Forest	1015	0.039	0.195
	Freshwater	1015	0.150	0.357
	Saltwater	1015	0.368	0.483
	Other Environmental	1015	0.096	0.294

	Regressor	Observations	Mean	Standard Deviation
Decade	Sixties	1015	0.048	0.214
	Seventies	1015	0.011	0.104
	Eighties	1015	0.156	0.363
	Nineties	1015	0.376	0.485
	Post 2000	1015	0.371	0.483
	Mulit-Regression	1015	0.902	0.300
	Sample Size	1015	967.74	3677.192
	Response Rate	1015	65.86	26.193
Valuation Method	Stated Preference	1015	0.349	0.477
	Revealed Preference	1015	0.149	0.356

Consumer Surplus Estimates

	Regressor	Estimate	Standard Deviation
Species Type	Small Game	-39.8***	7.919
	Freshwater Fish	9.887	7.093
	Saltwater Fish	-50.12*	27.9
	Wildlife Viewing	-10.63*	5.941
	WaterFowl	-37.76**	16.61
U.S. Region	Northeast	-4.268	7.598
	Midwest	-21.85***	4.997
	South	-3.506	7.182
	Multi-Region	-33.53**	7.914
Good Type	Freshwater	1.894	6.881
	Saltwater	74.97***	16.69
	Other		
	Environmental	34.47**	15.45

	Regressor	Estimate	Standard Deviation
Decade	Sixties	-18.43	13.18
	Seventies	-32.28***	9.513
	Eighties	-1.057	8.8
	Nineties	-5.228	9.549
	Multi-Regression	-33.53***	7.914
	Sample Size	0.0012**	0.000597
	Response Rate	-0.632***	0.139
	Valuation Method	1.908	6.332
	Constant	109.60***	14.97

*, **, ***Denotes significant at the 10%, 5% and 1% level

Conclusions

- Traditional Resource Assessments do not include the external costs of development

- Estimate these losses economically
  - Include as a perpetual loss

Thank You