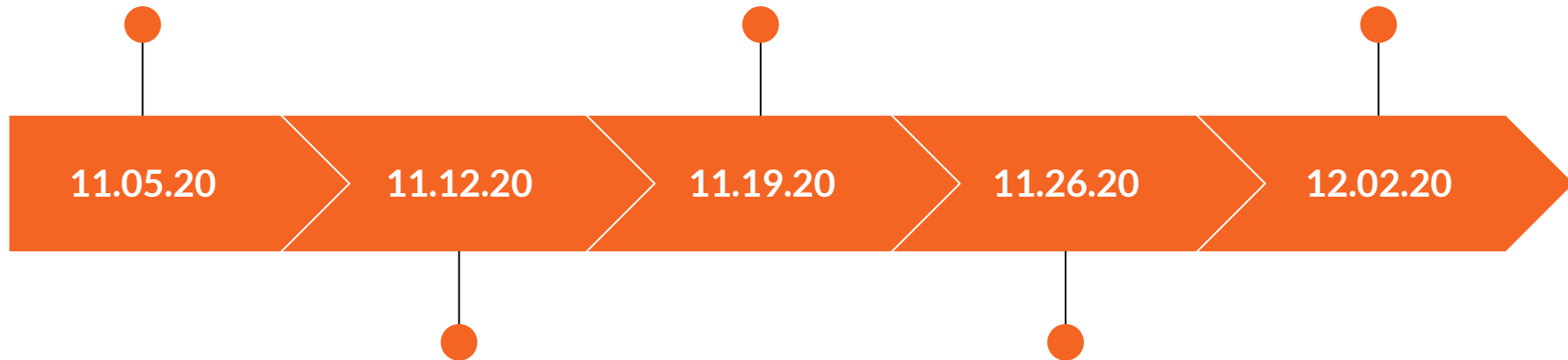

Relationship between Individual Happiness and Global Ecology

ECE 143 Fall 2020 Group 12:
Jimmy, Mia, Roumen, Varun

Looked at raw correlation between traits and resources (combining datasets)

Adjusted for variables and performed further analysis, including on outlier countries

Presentation



Removed outlier countries and noted them for further analysis

Distilled the most meaningful relationships for visualization

Overview

Do happier countries consume more?

What is the relationship between a country's happiness and its ecological resource consumption footprint?

Import World Happiness Report 2016 dataset

```
In [3]: happiness = pd.read_csv("../Data/2016.csv")  
happiness
```

Out[3]:

	Country	Region	Happiness Rank	Happiness Score	Lower Confidence Interval	Upper Confidence Interval	Economy (GDP per Capita)	Family	Health (Life Expectancy)	Freedom	Trust (Government Corruption)	Generosity	Dystopia Residual
0	Denmark	Western Europe	1	7.526	7.460	7.592	1.44178	1.16374	0.79504	0.57941	0.44453	0.36171	2.73939
1	Switzerland	Western Europe	2	7.509	7.428	7.590	1.52733	1.14524	0.86303	0.58557	0.41203	0.28083	2.69463
2	Iceland	Western Europe	3	7.501	7.333	7.669	1.42666	1.18326	0.86733	0.56624	0.14975	0.47678	2.83137
3	Norway	Western Europe	4	7.498	7.421	7.575	1.57744	1.12690	0.79579	0.59609	0.35776	0.37895	2.66465
4	Finland	Western Europe	5	7.413	7.351	7.475	1.40598	1.13464	0.81091	0.57104	0.41004	0.25492	2.82596
...
152	Benin	Sub-Saharan Africa	153	3.484	3.404	3.564	0.39499	0.10419	0.21028	0.39747	0.06681	0.20180	2.10812
153	Afghanistan	Southern Asia	154	3.360	3.288	3.432	0.38227	0.11037	0.17344	0.16430	0.07112	0.31268	2.14558
154	Togo	Sub-Saharan Africa	155	3.303	3.192	3.414	0.28123	0.00000	0.24811	0.34678	0.11587	0.17517	2.13540

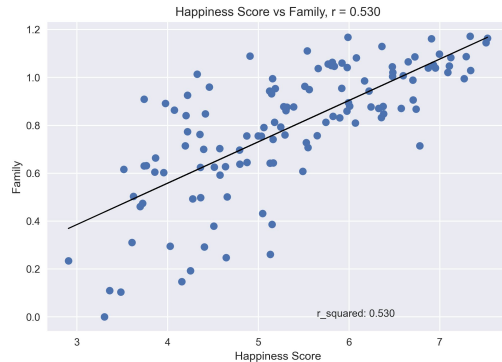
Import Global Ecological Footprint 2016 dataset

```
In [2]: ecological = pd.read_csv("../Data/countries.csv")
ecological
```

Out[2]:

	Country	Region	Population (millions)	HDI	GDP per Capita	Cropland Footprint	Grazing Footprint	Forest Footprint	Carbon Footprint	Fish Footprint	...	Cropland	Grazing Land	Forest Land	Fishing Water	Ur L
0	Afghanistan	Middle East/Central Asia	29.82	0.46	\$614.66	0.30	0.20	0.08	0.18	0.00	...	0.24	0.20	0.02	0.00	(
1	Albania	Northern/Eastern Europe	3.16	0.73	\$4,534.37	0.78	0.22	0.25	0.87	0.02	...	0.55	0.21	0.29	0.07	(
2	Algeria	Africa	38.48	0.73	\$5,430.57	0.60	0.16	0.17	1.14	0.01	...	0.24	0.27	0.03	0.01	(
3	Angola	Africa	20.82	0.52	\$4,665.91	0.33	0.15	0.12	0.20	0.09	...	0.20	1.42	0.64	0.26	(
4	Antigua and Barbuda	Latin America	0.09	0.78	\$13,205.10	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	N
...
183	Vietnam	Asia-Pacific	90.80	0.66	\$1,532.31	0.50	0.01	0.19	0.79	0.05	...	0.55	0.01	0.17	0.16	(
184	Wallis and Futuna Islands	Asia-Pacific	0.01	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	N
185	Yemen	Middle East/Central Asia	23.85	0.50	\$1,302.30	0.34	0.14	0.04	0.42	0.04	...	0.09	0.12	0.04	0.20	(
186	Zambia	Africa	14.08	0.58	\$1,740.64	0.19	0.18	0.33	0.24	0.01	...	0.24	0.94	0.99	0.02	(
187	Zimbabwe	Africa	13.72	0.49	\$865.91	0.20	0.32	0.29	0.53	0.01	...	0.15	0.32	0.12	0.01	(

Data Cleaning

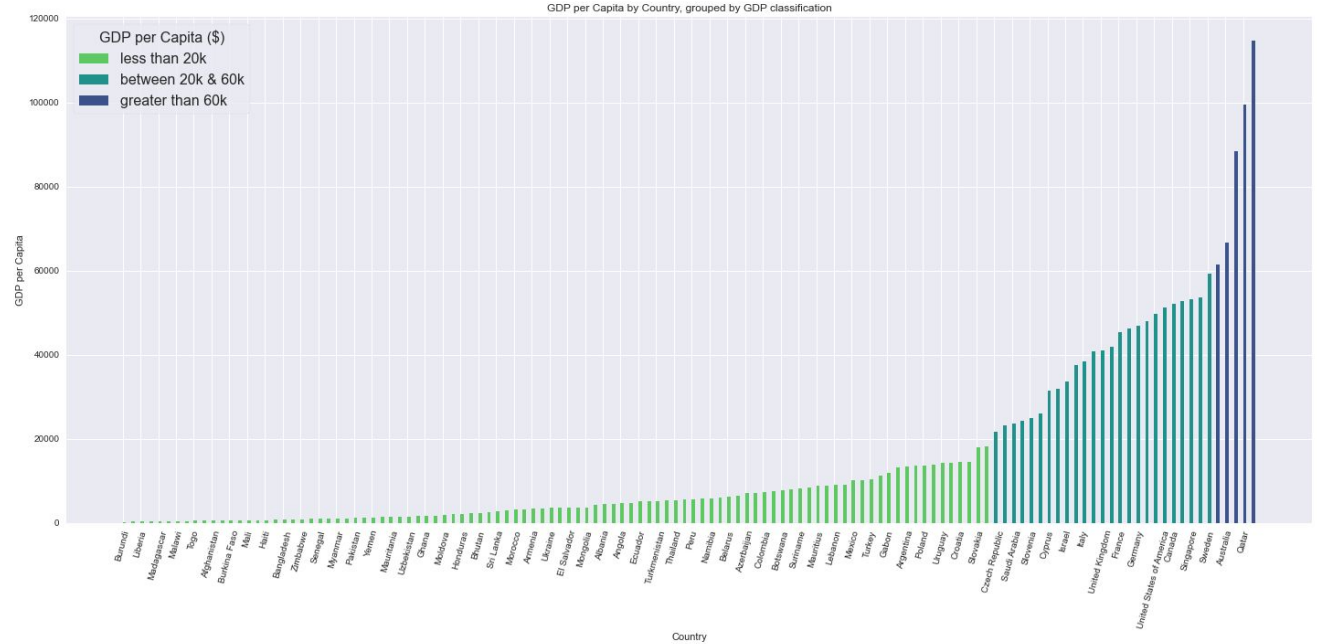


Steps:

1. Remove Countries with NaN values
 2. Remove Countries that aren't in both datasets
 3. Replace “\$” characters in monetary quantities
 4. Merge datasets on Countries column
 5. Remove Columns with High Correlation with Happiness Score (Family, Life Expectancy, etc.)
-

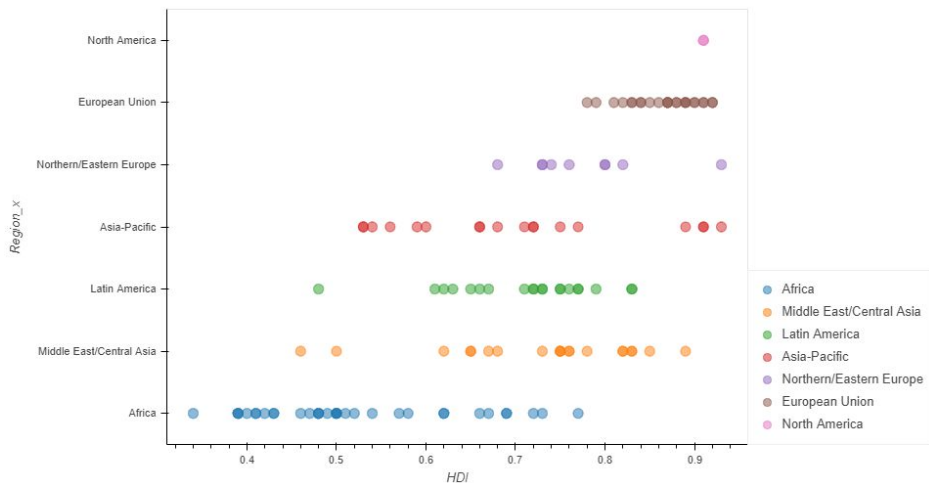
Investigation

Getting to know the Data on Economic Terms

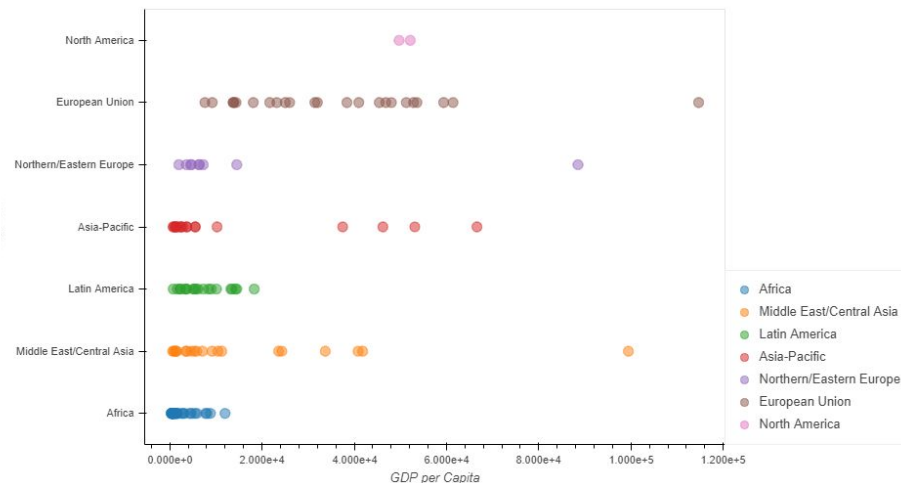


Getting to know the Data on Economic Terms

In terms of HDI

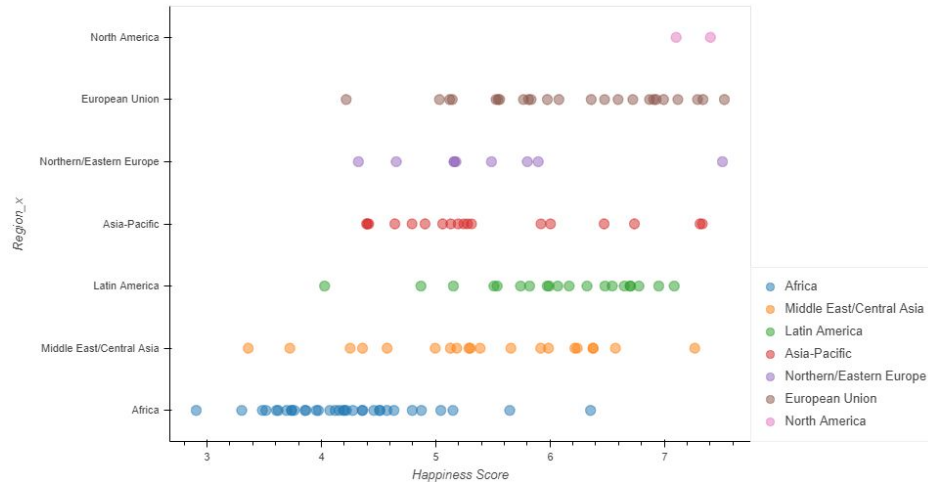


In terms of GDP per Capita

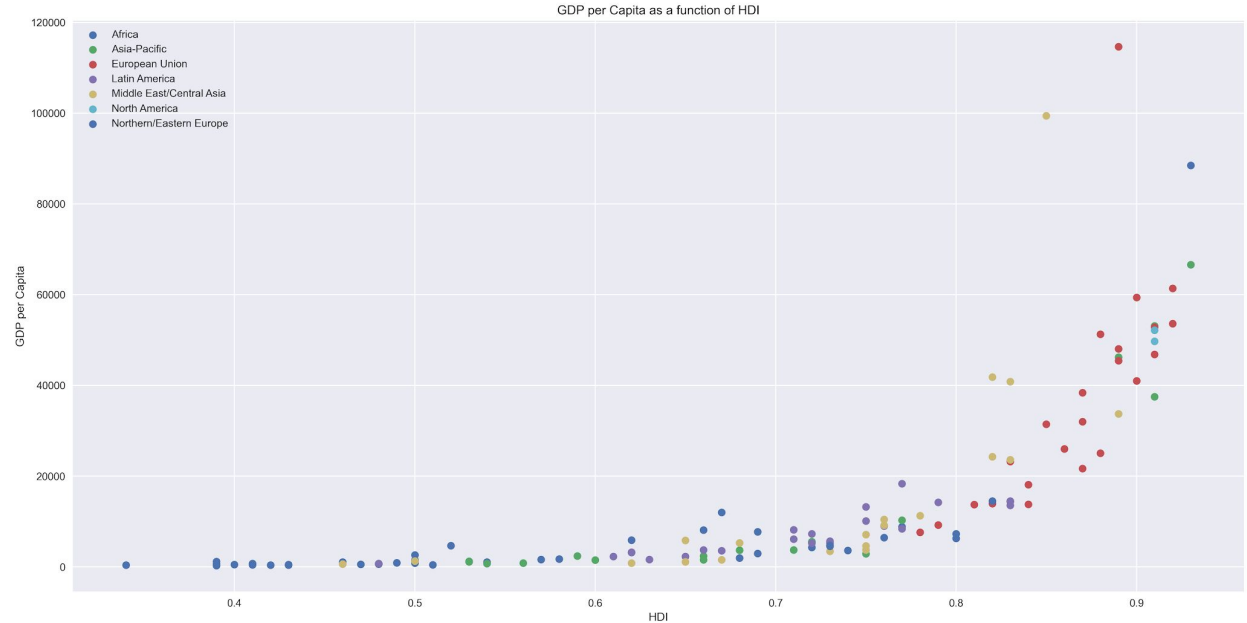


Getting to know the Data on Economic Terms

In terms of Happiness

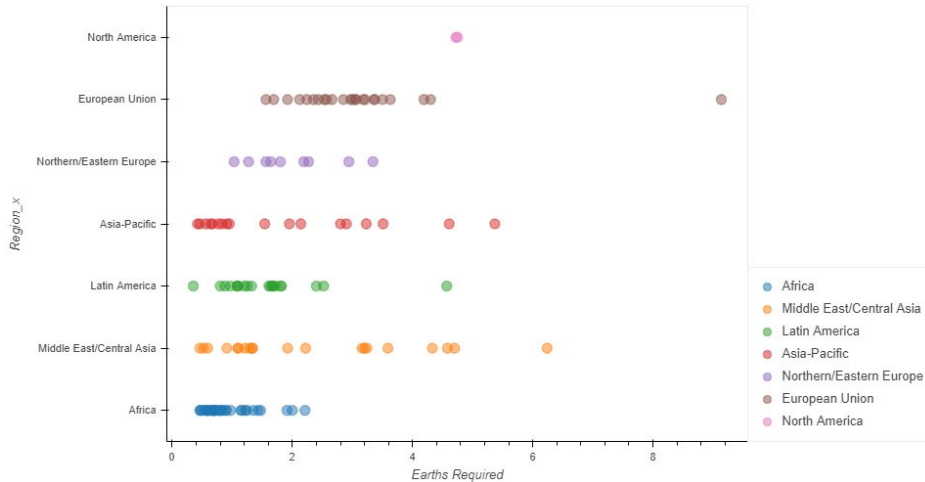


Getting to know the Data on Economic Terms



And on Environmental Terms

In terms of Earths Required

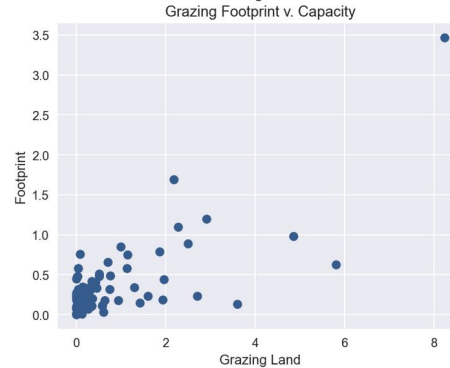
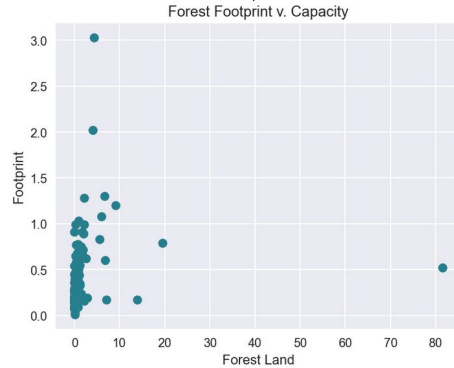
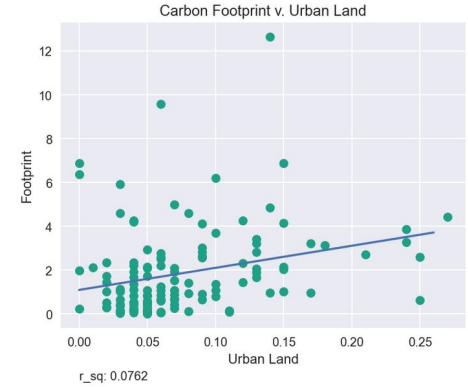
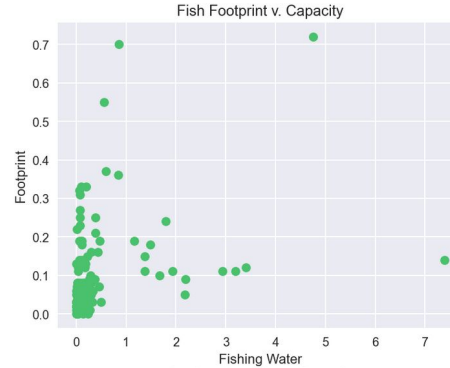
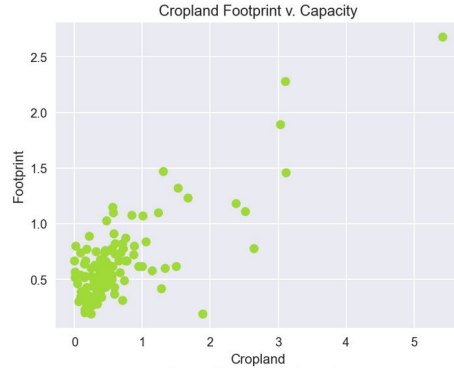


Analyze footprints

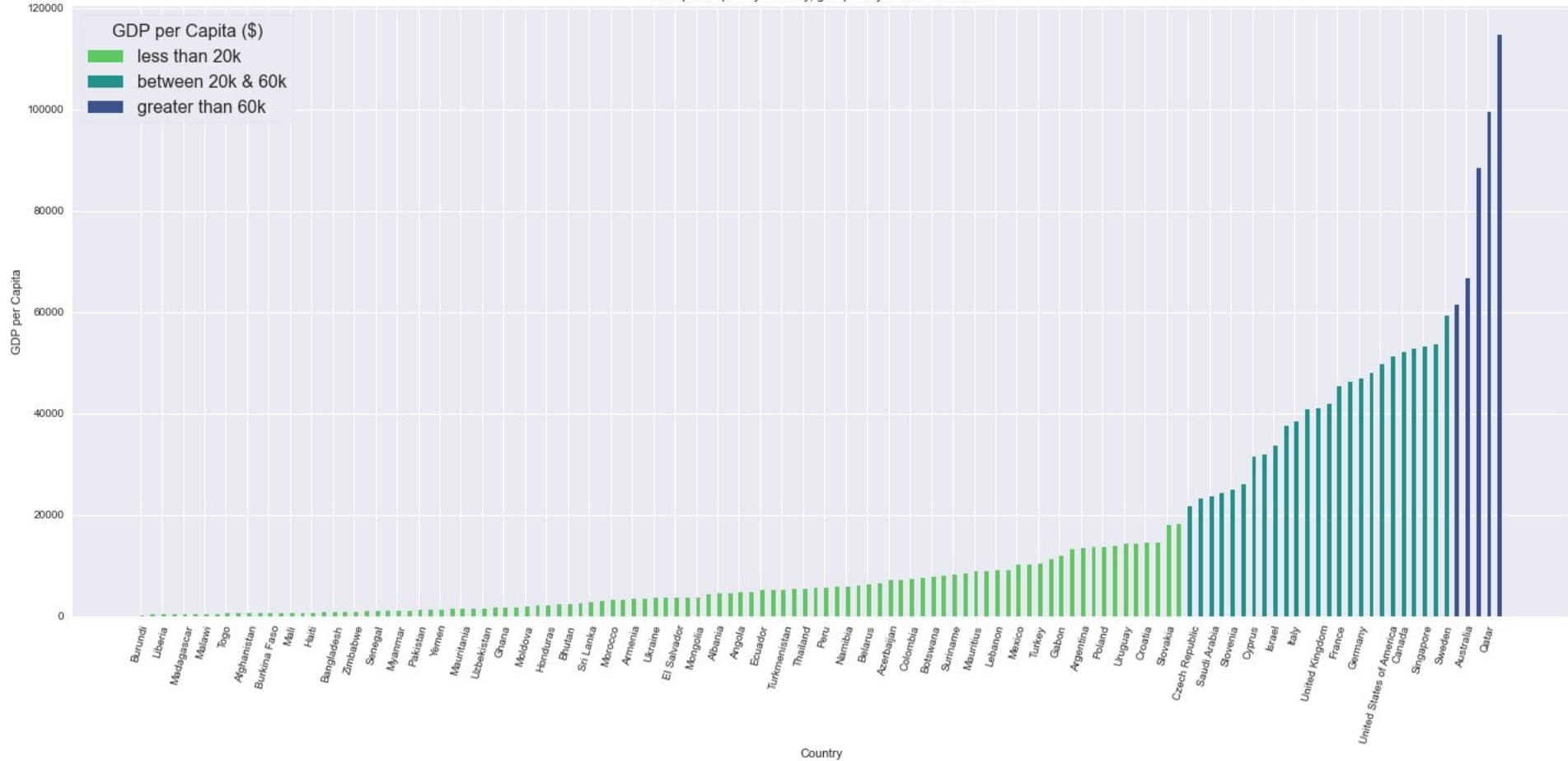
- Before we look into footprints vs different traits, we would like to mention the correlations between footprints.
- After calculation, the correlation between carbon footprints and total footprints is 0.9493.
- This will be reflected in later plots.

	Cropland Footprint	Grazing Footprint	Forest Footprint	Carbon Footprint	Fish Footprint	Total Ecological Footprint
Cropland Footprint	0.141236	0.003564	0.072256	0.309940	0.004692	0.541887
Grazing Footprint	0.003564	0.149946	0.005901	0.077711	-0.003167	0.236315
Forest Footprint	0.072256	0.005901	0.153252	0.161879	0.003034	0.407274
Carbon Footprint	0.309940	0.077711	0.161879	4.014804	0.040760	4.635601
Fish Footprint	0.004692	-0.003167	0.003034	0.040760	0.014939	0.060150
Total Ecological Footprint	0.541887	0.236315	0.407274	4.635601	0.060150	5.938177

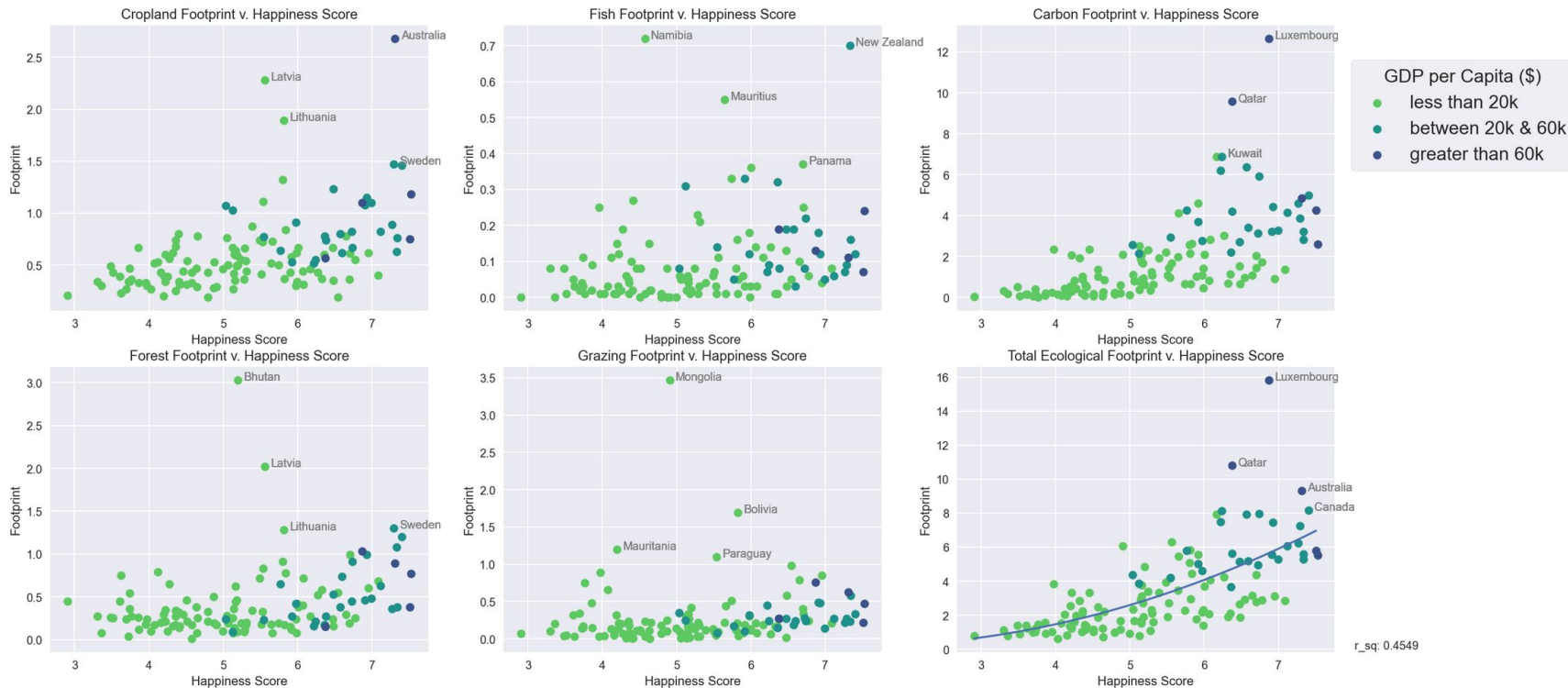
And on Environmental Terms



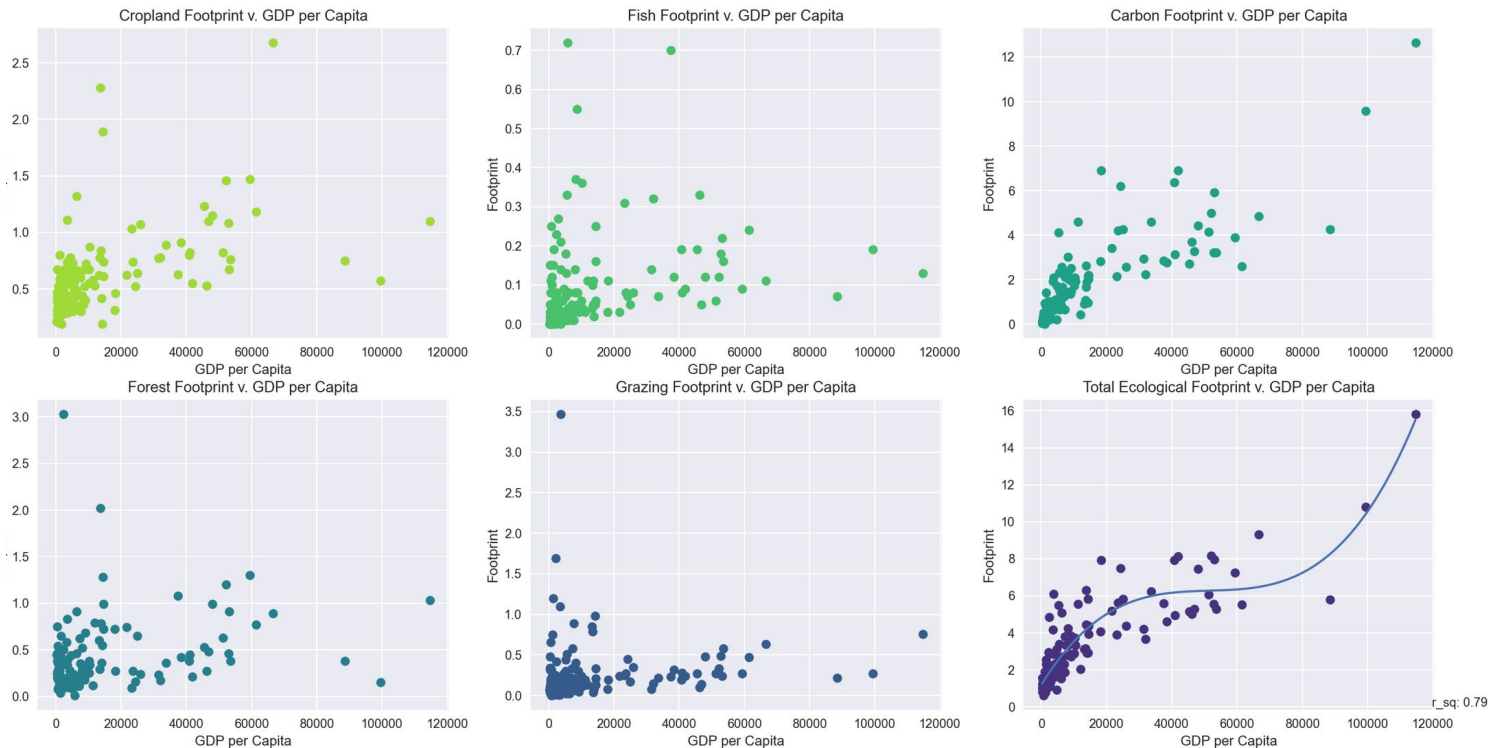
GDP per Capita by Country, grouped by GDP classification



Footprint v. Happiness Score



Footprint v. GDP per Capita



Conclusions

Predictors of Ecological Footprint

In order of prediction ability:

- Ecological Capacity
 - $r^2 = 0.0762$
 - Happiness
 - $r^2 = 0.4549$
 - GDP per Capita/HDI
 - $r^2 = 0.7989$
 - Most of a countries ecological footprint is its Carbon Footprint
 - Economic indicators are closely correlated across countries
-

Extras

Best Performing Countries

Top Environmental Performers

- Australia (Grazing)
 - Bhutan (Carbon)
 - Canada (Fishing)
 - Gabon (Grazing)
 - Suriname (Forest, Fishing)
 - Uruguay (Grazing)
-

A Case Study of Bhutan

Bhutan: Committed to Conservation



Tweet 

Bhutan is one of the smallest countries in the world. But its commitment to conservation is bigger than most.

Conservation of the environment is one of the four pillars of Bhutan's Gross National Happiness philosophy. As mandated in its constitution, Bhutan preserves (at all times) 60 percent of its land under forest cover. Bhutan has succeeded in doing so. More than 51% of the country is protected—the largest percentage of any Asian country. Most of it is intact forests interwoven with free-flowing rivers.

Evidence of this commitment to conservation is everywhere in Bhutan. Native wildlife—including endangered royal Bengal tigers, elusive snow leopards, elegant black cranes and elephants—all roam free in the country's 5 million acre network of protected areas. The people of this Buddhist kingdom can hold on to a fundamental birthright: living out life in a healthy environment. And one of the country's top industries—ecotourism—is thriving and growing.

- “As mandated in its constitution, Bhutan preserves (at all times) 60 percent of its land under forest cover.”
- “the Kingdom of [Bhutan](#) is already carbon negative: it takes more greenhouse gasses from the atmosphere than it emits.”

A Case Study of Bhutan

Bhutan: the world's first carbon-negative country

Bhutan produces 1.5 million tonnes of carbon every year, but thanks to the country's 72 per cent forest coverage, more than 6 million tonnes of carbon is absorbed

18 January 2017 | Websolutions



- “A 2015 survey found 91 per cent of Bhutanese people were narrowly, extensively or deeply happy.”
- “From 2009, Bhutan introduced a series of policies to ensure the country stayed carbon neutral including a constitutional amendment to guarantee forested areas would not fall below 60 per cent, free hydroelectric power generated by Bhutan’s many rivers was prioritised over fossil fuels and export logging was prohibited.”
- “The Bhutanese government has partnered with Nissan to provide hundreds of electric cars to the country— thousands more are to be supplied in the near future.”
- “The government has also started providing rural farmers with free electricity to lessen their dependence on wood stoves for cooking.”

A Case Study of Bhutan

