BOSTON MA
CHICAGO IL
MIAMI FL
PORTLAND OR
SAN DIEGO CA
LONDON UK

NATURAL RESOURCES

Adam Toczylowski

MEKETA INVESTMENT GROUP
100 Lowder Brook Drive, Suite 1100
Westwood, MA 02090
meketagroup.com

July 2018

ABSTRACT

In this paper we examine the likely return behavior of investments in natural resources. We briefly describe this market and discuss the investment issues involved. We primarily focus on private market investments in natural resources assets, as these have been shown to offer attractive and durable benefits over similar public market investments. However, we do utilize historical public market index data to examine the return behavior and correlation relationships that natural resources investments provide. We also explore the relationship that natural resources have with traditional institutional portfolios and the portfolio risk/return and inflation linkage benefits of adding an allocation.

INTRODUCTION

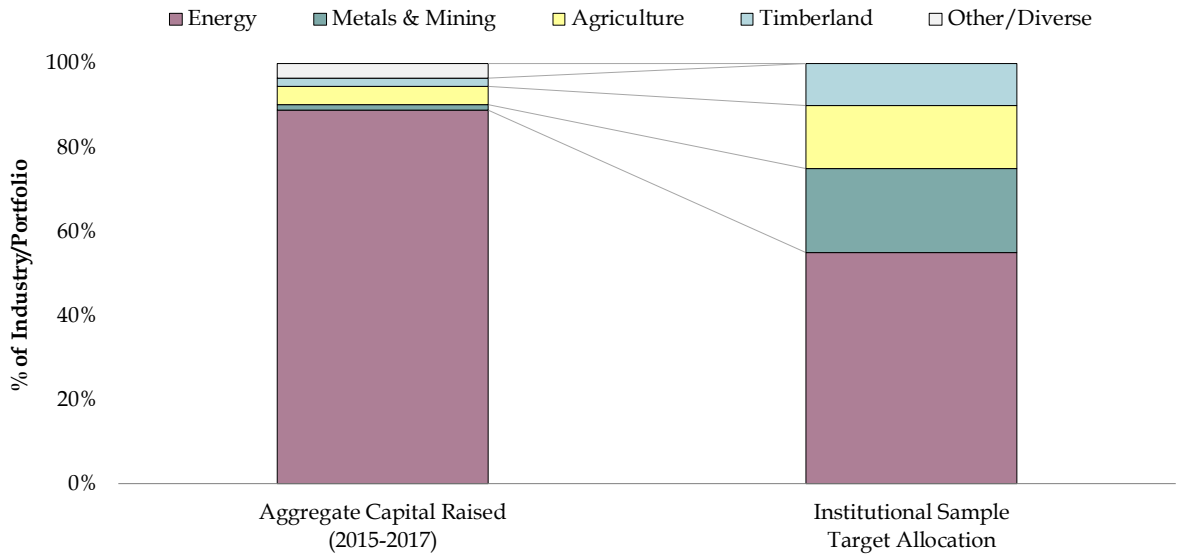
Natural resources are fundamentally products of the earth that have value, either in a relatively unmodified form, such as gold or diamonds, or as a key input to manufactured goods, such as iron ore into steel and cherry wood into cabinets. A broad asset class, natural resources can be divided into two general categories: ***extracted resources***, such as oil, gas, and metals, which are depleting; and ***harvested resources***, such as agricultural crops and timber, which are regenerating. Extracted and harvested resources have different risks and return drivers, so understanding each category, and the sub-classes within them, will help inform the appropriate allocation an investor makes to the asset class.

Natural resources have characteristics that can make them important components of an investment portfolio. Investments in natural resources have exhibited equity-like returns, positive correlations with commodity prices, and outperformance during periods of high inflation. As a result, investors often look to the natural resources asset class to provide valuable diversification benefits, a hedge against inflation, and favorable risk-adjusted investment returns over the long term.

NATURAL RESOURCES INVESTMENT UNIVERSE

Putting the investable private natural resources universe into perspective provides an understanding of the size of the respective markets as well as how investors may allocate capital across its sub-asset classes. Exhibit 1 illustrates the amount of private capital raised for natural resources funds between 2015 and 2017 relative to a sample target allocation to a diversified natural resources portfolio.

Exhibit 1: Private Natural Resource Capital Raised vs. Sample Target Allocation [1]



It is clear that the energy sector dominates fundraising; however, a well-diversified natural resources portfolio will also include meaningful allocations to mining, timber, and agriculture assets – somewhat beyond their market share.

Private natural resources partnerships raised over $190 billion during the 2015 to 2017 period. Investors committed nearly 90% of this capital to over 150 energy partnerships globally, indicative of the large manager universe and significant investment opportunity set. The aggregate $21 billion raised for metals and mining, agriculture, and timberland strategies across 60 funds is meaningful but represents a much smaller opportunity set relative to energy.

The following sections provide an overview of extracted and harvested resources and narratives of the major sub-asset classes across energy, metals and mining, agriculture, and timberland.

[1] Source: Preqin Annual Private Capital Fundraising 2015, 2016, & 2017.

EXTRACTED RESOURCES

Extracted resources investment strategies generate returns from a variety of economic activities related to non-renewable products of the terrestrial and sub-terrestrial environment. These non-renewable products are generally associated with two major commodity complexes: energy (e.g., crude oil, natural gas, and natural gas liquids), and metals and mining (e.g., base, industrial, and precious metals). Within these two complexes, different levels of risk and return can be constructed around the upstream, midstream, and downstream segments of the value chain. For our descriptions below, we have combined midstream and downstream since investment opportunities in this sector share similar characteristics.

Upstream — Exploration and Production ("E&P") usually involves leasing or obtaining rights to promising tracts of land, exploratory drilling, and extracting the resources. This process begins with technical due diligence to assess the feasibility, method, and cost of extraction as well as the quality and quantity of the underground commodity. E&P tend to have high exposure to commodity prices that can be partially offset with hedges and derivative contracts. Investors should expect a higher risk and return profile for earlier-stage strategies relative to later-stage strategies that are either producing or near production. Operational efficiencies and continued advancements in horizontal drilling and hydraulic fracturing technology has made the U.S. a significant contributor to the global hydrocarbon supply.

Midstream and Downstream — Activities in this segment of the value chain are typically associated with energy, but may also apply to certain metal and mining processes. Investments associated with these sectors include gathering lines for oil and gas wells, short- and long-haul pipelines, hydrocarbon processing and compression stations, storage silos, power generation facilities, and liquefied natural gas export terminals. Midstream and downstream energy investments may include greenfield development projects, improvements to brownfield facilities, or repurposing existing assets. These investments generally have a lower risk and return profile relative to E&P due to lower commodity price dependency. Some investments are structured with price-certain contracts (e.g., take-or-pay, volumetric commitments, offtakes) and profit from a spread to a commodity price, which may not move in symphony with changes in the cost of either the input or the output commodity. Other contracts can be established with indirect commodity exposure through long-term acreage dedications and joint ventures with commodity producers. As E&P activity continues to increase in the United States, the need for further midstream and downstream investment will be significant.

In the discussion that follows, although we focus on private markets natural resources investments, we necessarily must rely on public market data for historical returns analysis. This provides important return and diversification profiles, but may not be wholly indicative of what a private market investor may expect.

Energy

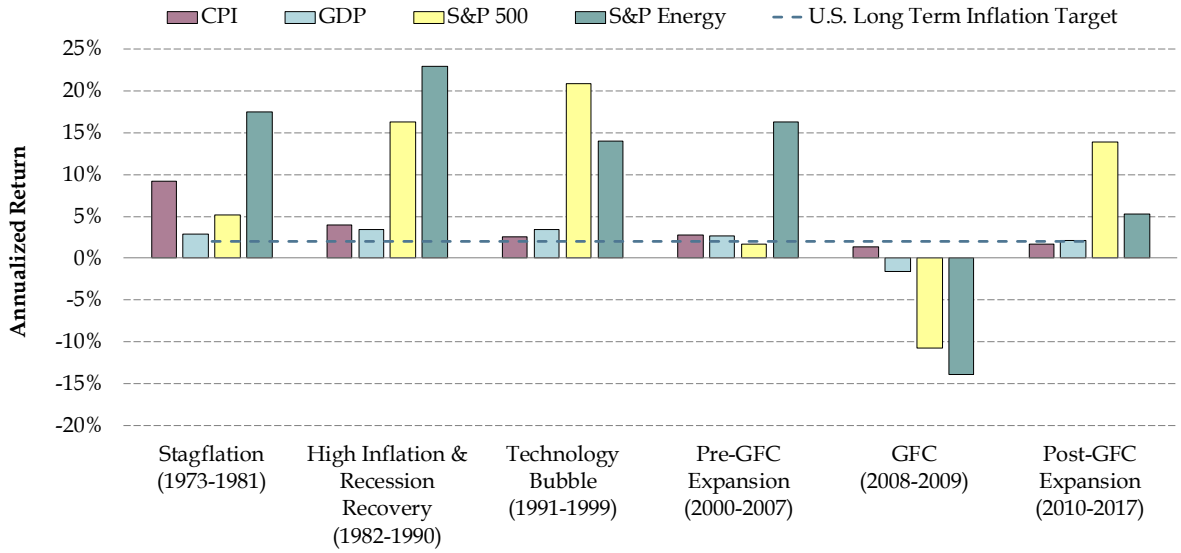
The energy sector includes oil and gas activities across the value chain from upstream to downstream and includes production and equipment and services operations.

Oil and natural gas investments are the dominant segment of the investable private natural resources universe, representing 90% of the capital raised over the past three years. Energy investments have traditionally been thought of as providing an inflation hedge to a portfolio. To look into this theory, our analysis of oil and gas investments, represented by the S&P 500 Energy Index ("S&P Energy"), is segregated into different periods of inflation and economic growth in Exhibit 2.

The analysis begins with 1973 to 1981, a time with significantly high inflation. The U.S. Federal Reserve aims to maintain a long-term inflation rate of 2.0%, whereas annualized inflation for this nine-year period was 9.2%. At the outset of the high inflation period, the U.S. experienced a recession from 1973 to 1975, which coupled with high inflation and high unemployment was known as stagflation. For these three years, the S&P 500 experienced an annualized loss of 5% while the S&P Energy *gained* 4%. Although the recession ended in 1975 and the economy experienced growth for the rest of the decade, inflation remained high. Over the total nine years of this high inflation environment, the S&P Energy outperformed the S&P 500 by an average of 12% per year.

Beginning with a recession in 1982, inflation decreased to lower levels, but still remained higher than the inflation targets. For the period 1982 to 1990, inflation averaged 4% per year with the S&P Energy outperforming the S&P 500 by almost 7% per year. Through the 1990s, the economy continued to be strong, with increasing equity valuations, primarily in the technology sector, leading to high returns in that sector as well as energy. S&P 500 returns were particularly strong as the technology bubble reached its peak. Other periods we analyzed include the run up in oil and natural gas prices through the early 2000s and the recession later that decade. Overall, during periods of high inflation and increasing economic growth, natural resources have displayed the potential to enhance portfolio returns. Not all times can be explained by these economic factors, as shown with the 1991-1999 and 2000-2007 periods having very different S&P 500 returns despite similar inflation and economic growth levels. However, the 1970s and 1980s were the highest period of returns for natural resources and coincided with the highest inflation periods.

Exhibit 2: Energy Stock Performance for Different Inflationary and Economic Periods [2]



The universe of investable energy companies is diverse and includes various risk and return profiles. Each sub-sector will have different risk profiles including exploration exposure, commodity exposure, operational efficiency, and leverage. Within the oil and natural gas segment, there are firms that specialize in exploration & production, drilling services, rig equipment manufacturing and services, transportation of material, and others that refine the products into end-user fuels. Furthermore, many firms engage in one or more of the above activities, and they are typically classified as "integrated" oil & gas companies. The market prices of these various subsectors have fluctuated over time, as shown in the following chart, which displays annual price returns for various energy sub-sectors since 2006.

Exhibit 3: Annual Returns for Traditional Energy Sub-Sectors [3]

2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
35%	48%	-22%	65%	43%	48%	84%	51%	16%	28%	57%	31%
19%	44%	-35%	60%	39%	15%	12%	31%	0%	-14%	33%	2%
16%	41%	-50%	42%	27%	-4%	8%	27%	-7%	-19%	32%	-3%
5%	33%	-59%	40%	19%	-6%	4%	22%	-8%	-29%	25%	-6%
3%	30%	-62%	-1%	9%	-11%	2%	20%	-11%	-34%	24%	-15%
-5%	14%	-64%	-22%	4%	-12%	0%	12%	-43%	-49%	2%	-19%

Integrated Oil & Gas	Oil & Gas Drilling
Exploration & Production	Refining & Marketing
Equipment & Services	Storage & Transportation

[2] Source: Bureau of Labor Statistics, fred.stlouisfed.org, & Bloomberg. Indices used for data analysis were S&P 500 Total Return Index and S&P 500 Energy Total Return Index.

[3] S&P 500 sub-sector index total returns from Bloomberg.

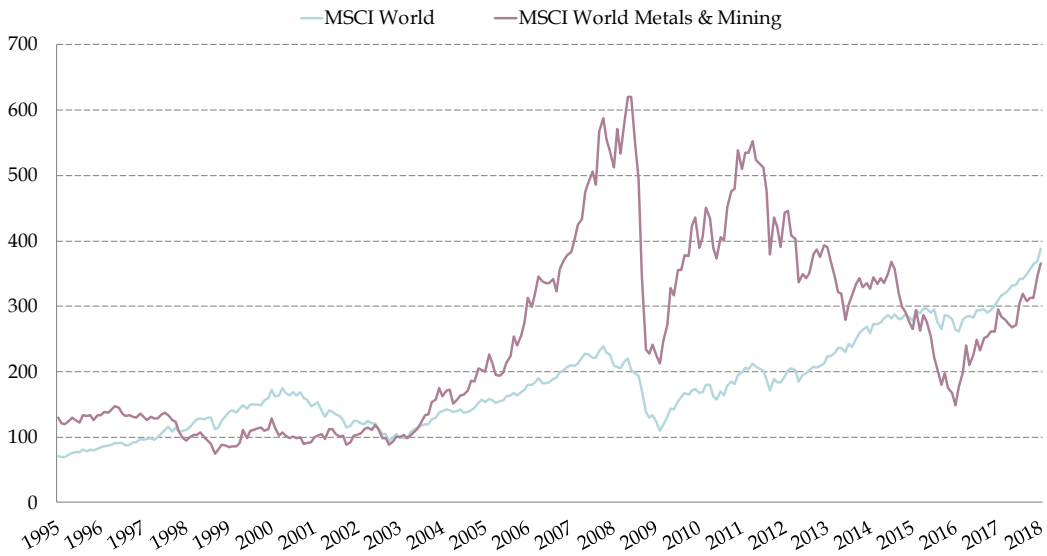
Year-to-year returns across the subsectors show high volatility and randomness. However, the overall return is fairly consistent, with integrated, refining and marketing, and storage transportation all having 12-year annualized returns around 7%. E&P and equipment & services both delivered approximately a 3% return and only drilling services had a negative return over that time. Notably, energy investment operators have a wide availability of instruments to hedge commodity price risk to control some of the volatility within the sector. Typically managers will hedge a portion of production out one to three years while leaving a percentage exposed to the commodity price for potential upside.

Metals & Mining

The other extracted resource strategy is metals & mining. Mining projects are subject to a number of risks ranging from commodity price exposure, quality of mined product, geographic exposure, large capital expenditure requirements, and debt covenants for levered projects. Mining investments are found globally and are often in difficult-to-access areas that can require infrastructure prior to extraction. The timeline to advance a project from exploration to production includes permitting, engineering, infrastructure completion, and mine construction that can take several years. The main two types of mining projects are surface mining and underground mining. Surface mining can be extracted via an open pit or quarry by removing the overburden to access the material. Underground (sub-surface) is more labor and capital intensive as it seeks to reach deeper deposits that usually have higher-value products. Based on all of these factors, the industry can have volatile and cyclical returns.

Exhibit 4 shows the MSCI World Metals & Mining Index versus the MSCI World Index. The high reward aspect of the sector was apparent in the early 2000s during a high point of the investment cycle until the market crash in 2008. This mining bubble was assisted by increasing Chinese industrialization, which had high demand for global commodities, and by technology advances, which increased demand for rare-earth metals that power many new devices. After the 2008 crash, the market recovered with assistance from various global stimulus packages. The resulting over-buildout and development of high cost projects contributed to a global mining downturn that lasted into 2016. These extreme events within the history of the mining industry emphasize the importance of understanding its cyclical nature and how to capitalize on investment opportunities.

Exhibit 4: Market Price of MSCI World Metals & Mining and MSCI World Index [4]
100 = January 2003



Mines are usually described by the primary commodity, but in reality a mine will contain several metals with varying grades of quality. The quality is not known for certain until after completion, although test drilling can give miners an estimate of what can be extracted if a mine is built. The two main classifications of metals are precious and industrial/base.

Precious Metals — Commodities that are classified as precious due to their scarcity and/or higher prices. The premium received for these metals are driven by the high demand, but short supply. The higher price point can also lead to higher volatility. The most well-known precious metals are gold and silver, known as coinage metals, and palladium and platinum, which are used in technology.

Industrial/Base Metals — Metals classified in this category have wider supply and lower price than precious metals. The most common base metals are the industrial, non-ferrous metals copper, zinc, lead, and nickel. Given the lower price point of these commodities, the cost and quality of the resource becomes critical to determine the feasibility of extraction.

Although the sector is considered highly volatile, diversification can be achieved through allocations to various metals. For example, looking at the price correlations of four metals (gold and silver, both precious, and copper and aluminum, both base) over the past 20 years, gold has been highly correlated with silver at 0.74, but less correlated with copper and aluminum at 0.29 and 0.23 respectively, while copper and aluminum have been strongly correlated at 0.66. Even with some diversification benefits, metals and mining remain a volatile sector that is primarily added to a portfolio for the potential of excess returns.

[4] Source: Bloomberg.

Due to the risk associated with exploration, permitting, and construction, projects are primarily funded through equity rather than debt. Mining projects typically take three to seven years (or longer) to bring to production with no income generation until after the mine is completed and producing. Due to the need for equity funding early in development, small-cap mining companies tend to publicly list earlier in a company's development and maturity relative to other sectors. These public companies are thinly traded and highly volatile as the investment community assesses the risk of each development project. Many mining companies are centered on one project, so the public stock price will reflect concentration risk into its valuation.

HARVESTED RESOURCES

Unlike extracted resources that are depleting in nature, harvested resources are generated through the growth of crops and trees, which are renewable independently or with human intervention.

As a sector that relies on the growth of its product, the first factors taken into consideration are the types and quality of seeds and soil. Both are crucial in the initial growth process and are areas that can be controlled by the operators. Also needing analysis, though out of the operators' control, is the climate of a harvested property. This can be a major factor in determining the return generated by an investment and the risk associated with a particular area. Having an understanding of each property's susceptibility to forest fires, pest infestation, drought, hurricanes, floods, etc., can have a major impact on the outcome of an investment. Income is a large component of the return for harvested properties and can help manage the risks of natural disasters and market downturns. Investors must determine the turnover and growth rates based on the specific properties to gain a better understanding of the income potential for operating and variable-lease properties that do not have long-term fixed leases in place. After factoring in the risks and potential rewards, an appropriate discount rate can be used for underwriting if targeting higher-risk areas.

In general, returns are expected to have an income component, primarily based on the sale of goods harvested, and an appreciation component, based on value-add initiatives and the eventual sale of the land. Historical returns of timberland and agriculture, as represented by the NCREIF Timberland and Farmland indices, demonstrate consistent annual income with the potential for land appreciation. Agriculture income has been strong over time and has averaged close to 7% annually. Timberland income has lately been depressed, averaging approximately 2.5% over the past decade. With the steady income, harvested investment strategies have a stable cash flow with the potential for additional returns from capital appreciation.

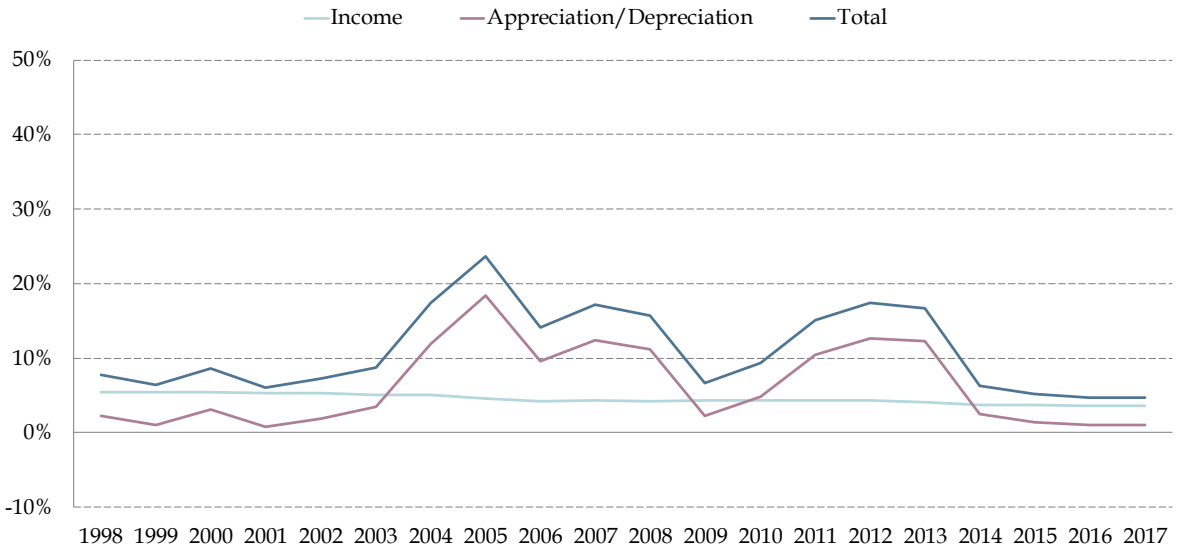
Agriculture

Agriculture continues to gain traction as an option for income-generating natural resources investments, either in the form of rent payments or operating income, within the private institutional investment space. At just over $8 billion in capital raised from 2015 to 2017, agriculture accounts for approximately 4% of the capital in the market, but by number of funds, was 14% of the market at 31 funds out of 217 closed. This is a result of smaller average fund size, at a little over $250 million per fund, versus the average for all private natural resources funds raised at just under $900 million per fund. The number of institutional quality managers is growing and opportunities primarily remain regionally focused at the smaller fund size.

Among agriculture investment strategies there is a wide range of risk/return profiles, depending on the types and stages of farmland investments. Investments can range from greenfield conversions to brownfield income-producing properties. Greenfield projects consist of converting a property into workable farmland or planting new long-term crops on farmland that will take several years to mature and produce such as grape vines or walnut trees. Brownfield projects consist of properties that are already producing and generating income when purchased, which makes the investment more reliant on income to generate the required return instead of development value-add. Whichever strategy is implemented, operators can adopt new technology or engage in value-add capex improvements to increase rent potential, yield, and land values. The two types of crops that investment managers can target are row crops and permanent crops.

Row Crops — As the name implies, row crops are planted in rows that can be easily grown and harvested once or twice a year. Common row crops include corn, wheat, cotton, and soybeans. Based on climate, soil quality, and current market prices, farms can determine the appropriate the type of crop(s) to grow each planting season. Agriculture managers typically purchase the land, but do not operate or own the crops. Income is derived by leases negotiated with land tenants (farmers) that can be fixed or variable payments. Fixed leases are the most common types of agreements and leave the owners with steady income and avoid direct commodity price exposure. Variable leases will provide the land owners with less constant income while offering the potential for higher payouts based on the farmer's sales. Leases are typically renegotiated every two to three years, so income will remain stable for longer periods. Exhibit 5 displays the annual income, appreciation/depreciation, and total return of row crop investments for the 20-year period ended 2017. Income has been steady and averaged 4.5% per year with a total return of approximately 11% per year.

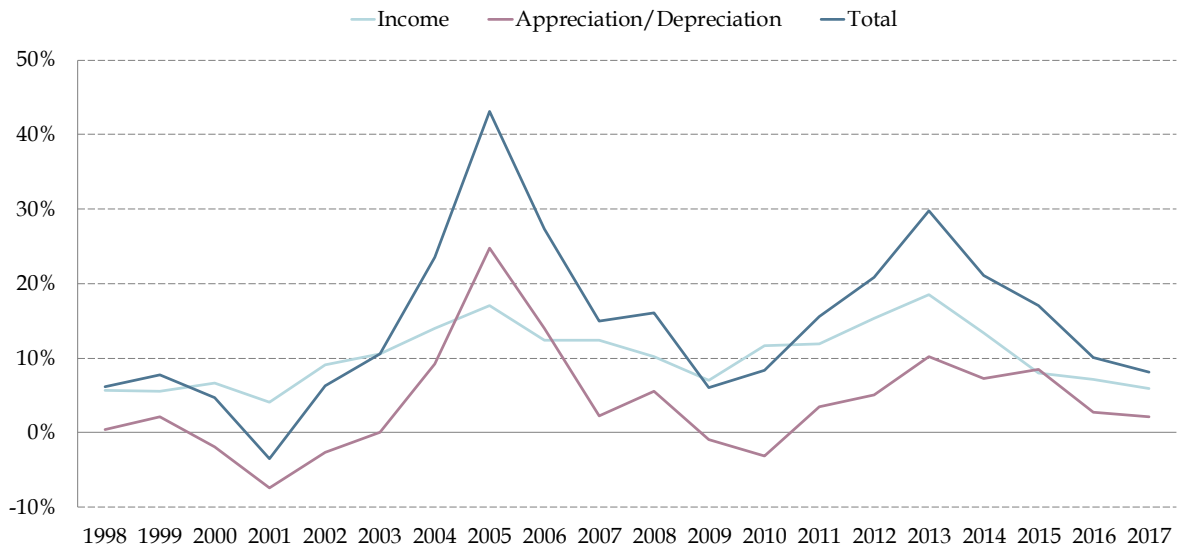
Exhibit 5: NCREIF Row Crops Annual Returns [5]
1998-2017



Permanent Crops — Permanent crops are perennial plants (trees, bushes, or vines) that are maintained but not replanted each year. The same plants are expected to be harvested for several, or even many, consecutive years. Examples of permanent crops are grapes, apples, cranberries, or walnuts. Unlike row crops, it is typical to own both the land and crops. Income on permanent crop properties is typically in the form of operating income that will be subject to fluctuations in commodity prices as the farms are usually operated by the land owners. Permanent crop owners will also bear the risk of damage to crops that could affect the harvest and value. With direct exposure to the harvesting income, the income and overall return profile for permanent crops is more volatile, as shown in Exhibit 6. For the 20-year period ended 2017, annualized income was 10.3% per year and overall permanent crop returns were 14.2% per year.

[5] Source: www.ncreif.org.

Exhibit 6: NCREIF Permanent Crops Annual Returns [6]
1998-2017



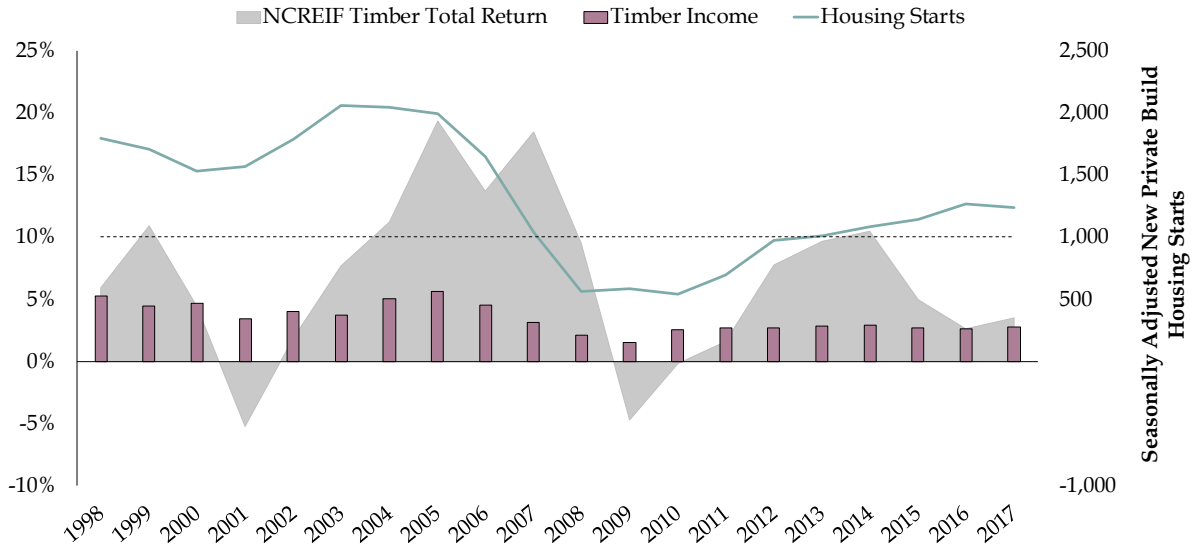
Timberland

Timberland properties are managed as plantations or naturally-managed forests. Unlike agriculture which must harvest their crops each year, timberland managers can choose to harvest or let the trees grow and "store on the stump" in anticipation of higher future prices. The higher future prices can result from a combination of market timing plus the fact that larger trees are worth more per unit than smaller trees. Tree farms are planted in spaced-out rows in tracts of land and continually replanted after harvest, while non-plantation forests are allowed to regenerate and regrow through natural process. Operators will manage their tracts by varying maturities and utilize silviculture techniques - the thinning out of certain trees - to optimize growth. The operators typically implement risk management controls that range from fire breaks to minimize the spread of potential wildfires to disease/pest management that depends on the forest's environment.

As with agriculture, timber investing relies on income as a major component of total return. Exhibit 7 shows that timber investments consistently realized harvesting income at approximately 5% per year until 2007. The financial crisis and subsequent housing market downturn negatively affected timber revenue as foresters elected to stop cutting activities with the depressed prices and lack of housing demand. Housing starts have begun to recover over the past two years and have crossed back above one million new starts per year on a seasonally-adjusted basis. With starts increasing, income rates have slowly followed, but are not back up to levels of the early 2000s. For the 20-year period ended 2017, annualized income was 3.4% per year and overall permanent crop returns were 6.5% per year.

[6] Source: www.ncreif.org.

Exhibit 7: Timber Returns and Housing Starts [7]



During the housing market downturn, timberland managers turned to alternative revenue sources to supplement a small portion of the depressed harvesting income. These included hunting leases, mitigation credits, and conservation easements. During these times, timber managers will reduce/suspend harvesting, depending on minimum harvesting contract obligations, and let the trees continue to grow; trees will gain value as larger trees can be sold at a premium price.

EXPECTED RETURN COMPONENTS

There are two primary sources of returns from investing in risky asset classes: income and appreciation.

Income

In the context of natural resources strategies, income may derive from the periodic sale of harvested or extracted goods, lease payments from tenant farmers, subsidy payments from governments, or dividends from equity stakes in common shares. Regular income serves to reduce volatility.

During periods of depressed prices, extraction or harvesting may be slowed or even stopped to wait for a better price environment. Oil and gas resources will typically have a percentage of production hedged for two to three years into the future to provide partial price certainty, while maintaining some of the upside potential. Timberland investments have the option to delay cutting and let the trees continue to grow until demand and prices increase. We expect income to be a relatively larger component of timberland, farmland, and producing upstream energy strategies.

[7] Source: NCREIF & FRED.

Appreciation

For natural resources strategies, appreciation may stem from an increase in the value of the underlying land, steady earnings growth increasing the value of a natural resources company, or increasing the valuation estimate on the commodity reserve. The first two causes usually lead to relatively steady and predictable growth over time, while commodity reserves are affected by many variables.

Oil and gas reserves fall under three categories: proved, probable, and possible. Each has a different discount rate applied to its valuation to account for the likelihood and risk of extraction. As more reserves are discovered or reclassified as proved, the valuation increases. Reserve volume is also only included in a valuation when the commodity is economical to extract. As a commodity price increases, additional reserves that have now become economical to produce will be added to the valuation, so changes in commodity prices will affect both the price and volume of the underlying reserves, which in turn can have a multiplying effect on the valuation.

STRATEGIC ALLOCATION

There are many reasons for investing in private natural resources. These include the diversification benefit of investing in assets that are not highly correlated with the rest of an investor's portfolio, the potential for an inflation hedge, earning current yield that smooths out the volatility of returns, and the possibility of producing returns in excess of public markets via a private market approach.

For purposes of this paper, we analyze the effects of adding a 5% allocation to a typical investor's portfolio taken from equities. As seen in Exhibit 8, both expected return and volatility (as measured by standard deviation) increase with an allocation to private natural resources. Overall, the allocation increases the portfolio return and volatility by 13 and 1 basis points respectively. The additional return for a minimal increase in standard deviation increases the portfolio Sharpe Ratio (measure of risk-adjusted return) from 0.33 to 0.34. Appendix A provides further detail on the allocations used for the calculation.

Exhibit 8: Institutional Fund Portfolio with Natural Resources [8]

	Hypothetical Institutional Fund (%)	Diversified Natural Resources (%)	Institutional Fund with Natural Resources (%)
Bonds	40	-	40
Stocks	48	-	43
Private Equity/Real Estate	12	-	12
Natural Resources	-	100	5
Expected Return	*7.00*	*9.93*	*7.13*
Expected Standard Deviation	*12.38*	*23.06*	*12.39*
Expected Sharpe Ratio	*0.33*	*0.30*	*0.34*

PORTFOLIO CONSTRUCTION

A portfolio of natural resources investments should be well-diversified to reduce the risks for which an investor is not compensated. This includes diversification by strategy, geography, manager, vehicle, individual investment, and vintage year. The expectations are for a diversified natural resources portfolio to enhance the investor's portfolio return and this increase should outweigh the additional portfolio volatility. The portfolio benefits from inclusion of an asset class that is not highly correlated to the public markets that make up a large percentage of a typical institutional investor's portfolio.

The construction of a diversified natural resources portfolio will be partly determined by the available set of investment opportunities. For example, there are fewer firms that offer vehicles to invest in U.S. farmland, and some of these are limited to large separate accounts (e.g., $50 million or more to properly diversify). The most robust universe of investment opportunities remains within the traditional energy complex at 90% of the private capitalization from 2015 to 2017, specifically focused on extraction, production, and distribution of hydrocarbons. As the shale revolution in the United States continues to evolve, the demand for increased infrastructure has also grown. With the need for more pipelines and gathering stations, midstream energy and integrated energy managers have also gained in availability. To create more optimally-diversified portfolios within natural resources, a meaningful allocation to other asset classes are needed, but the energy sector remains the largest target allocation.

Given the opportunity set and the investment characteristics of each component, a mature natural resources portfolio should emphasize energy investments with a bias toward extracted resources. Metals and mining is a high-risk, high-reward subsector that can enhance portfolio return. Mining investments are capital intensive and highly sensitive to commodity price exposure, so investors look for compensation for these risks. Because of these factors, a smaller percentage of the natural resources portfolio should be allocated to mining investments.

[8] From Meketa's 2018 Asset Allocation Study.

Harvested sectors provide lower risk strategies that can provide steady income and modest appreciation. Beyond broad economic growth, harvested resources have different returns drivers than the extracted resources sector and thus provide diversification benefits.

A key component of developing an investment policy for natural resources would include determining the allocation most appropriate for an institutional investor's risk and return expectations. For example, a greater desire for higher returns would necessitate a larger allocation to extracted resources. A sample allocation is depicted in Exhibit 9.

Exhibit 9: Natural Resources Sample Portfolio [9]

	Sample Allocation (%)	20-Year Expected Return (%)	20-Year Expected Standard Deviation (%)
Extracted			
Energy	2.8	10.2	26.0
Metals & Mining	1.0	10.6	35.0
Harvested			
Agriculture	0.8	7.2	13.0
Timber	0.5	6.6	12.0
Natural Resources Risk/Return Expectation	**5.0**	**9.9**	**23.1**

[9] From Meketa's 2018 Asset Allocation Study.

IMPLEMENTATION

There are several implementation decisions that should be considered prior to executing an allocation to natural resources, including choosing appropriate investment vehicles, understanding the costs and market cycles, and selecting a benchmark.

Investment Vehicles

Several categories of investment vehicles are available for investors who wish to invest in natural resources. The private vehicles primarily include closed-end funds, separately managed accounts, co-investments, and direct joint ventures. The publicly-traded vehicles are traditional open-end funds and strategies (like mutual funds) whose share prices fluctuate daily.

Most of the current universe of natural resources funds is structured similarly to private equity partnerships. They are closed-end private funds, generally with terms between ten and fifteen years, with several one-year extensions. They are structured with an investment period of three to five years and will usually invest in five to fifteen assets or portfolio companies. Although private partnerships are valued less frequently, the overall risk is high due to the relationship with commodity prices and the need for many private strategies to take on exploration and development risk. Private market investors have the ability to add value through control positions and long term project views. A control position in its investments will enable the fund manager to implement high quality management teams, disciplined capital deployment, and minimize company expenses. These factors will be key to providing excess returns over similar public market investments. For these reasons, we have a preference for achieving the majority of an investor's allocation to natural resources via private market funds. However, it may take several years to fully achieve the desired target allocation via investments in this format.

Separately managed accounts can also provide private natural resource exposure allowing for a customizable strategy compared to pooled commingled funds. Fees are typically lower, but a larger commitment is required to achieve appropriate diversification. Co-investments or direct joint ventures can provide selective exposure to individual opportunities. There are typically no fees with these investments, but has high concentration risk and requires additional resources and specialization to complete due diligence.

During periods of high inflation, natural resources stocks may be assumed to return more than broad public equity markets. If an investor is confident that such a period is forthcoming, then a larger allocation to natural resources stocks—especially stocks of upstream energy companies—may be warranted.

Costs

Like private equity partnerships, the fees on private natural resources funds are high, and generally include both a management fee (ranging from 1.5% to 2.0% per year) and a performance-based fee. The latter often has a 6% to 8% net preferred return, which – if achieved—permits the manager to assess a carried interest of 15% to 20% of profits. All of the

costs and fees associated with private natural resources investing are higher than for public market securities and will be dilutive to returns.

Another characteristic that natural resources funds will share with private equity partnerships is the J-curve, which is the pattern of flat to negative returns in the early years of a partnership. However, this is mitigated by the income stream generated by many natural resources assets shortly after their acquisition and dependent on the production profile. Hence, the J-curve should be less pronounced than that to which private equity investors are accustomed.

An allocation to natural resources will require added commitments by the institutional investor in time and resources. Administratively, the capital calls and distributions associated with private natural resources funds are unpredictable, so investors would need procedures to accommodate these cash flows reliably and efficiently. These assets will also require additional monitoring by the investor. These are the circumstances for all private market investments in closed end funds.

Timing

Most of the underlying industries in the natural resources category can be highly cyclical, driven by the cyclicality of commodity prices. Commodity prices themselves are largely dependent on the rate of global growth. Therefore, the least attractive time to invest in natural resources would be when global growth is at a peak – if such a peak could be identified.

Trying to time a market on a quarter-by-quarter basis is extremely difficult, and we advise against doing so. Rather, we recommend a more strategic approach, by setting target allocation ranges wide enough to allow for modest shifts relative to the long-term target. An investor concerned about an entry point might consider allocating assets to the space gradually, and if a particular sector appears temporarily unattractive, a more gradual approach to investment in that sector may be warranted.

Benchmarks

As with any asset class, investors in natural resources must select an appropriate benchmark to accurately measure the allocation's relative performance. While public market benchmark indices exist for natural resources, it is critical to identify the underlying components and geographies of theses indices, as many have a sector structure that will not match that of the investor's portfolio (e.g., greater emphasis on E&P). It is also important to understand their risk metrics and return drivers, to ensure that the selected public market benchmark is indeed the appropriate measuring tool.

Once a public market benchmark has been identified, a public market equivalent ("PME") methodology can be used to measure performance, whereby the same cash flows of the private markets strategy are assumed to be invested at the same time in the public market benchmark. PME calculations are necessary since public market measurements are not directly comparable to private investments (due to the illiquid nature of the private investments and investors not having control of cash flow size or timing). To account for these differences, a private investment should use an inception-to-date internal rate of return ("IRR") calculation for

performance measurement, instead of a time-weighted return that presents a compound rate of growth without taking into account the size or timing of cash flows. Simulating cash flows and calculating a remaining holding of the public market index produces an IRR that can be used to benchmark a real assets portfolio.

For large and highly-diversified private natural resources portfolios, it may be appropriate to use a customized benchmark, which could include a combination of public market indices, or a widely-published private natural resources benchmark. Private benchmarks have their limitations as well, since details on the underlying components are not always readily available to determine appropriateness. Private market benchmarks can also have survivorship bias, as underperforming investments may cease performance reporting, which misrepresents the universe and artificially increases the overall private market benchmark returns.

SUMMARY

Meketa Investment Group believes that an allocation to natural resources can be beneficial for institutional portfolios.

Natural resources investments have the potential to enhance an investor's risk-adjusted return and hedge against increases in inflation. The energy sector dominates the investable universe and provides the best opportunity for an inflation linkage for a portfolio, and we recommend that over half of the natural resource exposure be allocated to that sector. Returns are generated through a combination of income and appreciation. Income works to stabilize the long-term returns of upstream oil & gas and harvested investments. However, returns are still volatile in this sector due to the relationship to commodity prices.

An investor must understand the risks associated with an allocation to natural resources and the liquidity constraints of a long-term private investment. The risks may lead to volatility for an investor's portfolio, but also have the potential to increase the return and Sharpe ratio. Diversification benefits can be seen at the portfolio, sector, and subsector levels (e.g., the fluctuation of year-to-year returns of the different components within oil and gas). Also, the return drivers and correlations of various extracted and harvested sectors create returns in different ways. Investors' return requirements, liquidity needs, ESG mandates, and risk tolerance vary, so each investor must determine the allocation within natural resources that would be most appropriate and beneficial for their objectives.

GLOSSARY

Base metals: Non-precious, non-ferrous metals that include copper, aluminum, lead, nickel, tin, and zinc.

Downstream: Portion of the energy chain that includes oil refineries, petrochemical plants, power generation, and distribution outlets.

E&P: Acronym for "Exploration and Production" that relates to the exploration, development, and production of crude oil or natural gas reserves. E&P is also referred to as the upstream sector.

Hedging: Strategy used to limit or offset exposure to pricing risk of an underlying commodity. A common way to execute this strategy is through the use of futures contracts, a financial derivative that allows for the sale of a commodity at a pre-specified price in the future, whether or not the market price increases or decreases at the time.

Hydrocarbon: A hydrogen and carbon compound created from the decomposition of organic material over time. Most hydrocarbons are found naturally in fossil fuels such as crude oil, natural gas, and natural gas liquids.

Midstream: The portion of the energy chain that gathers, transports, treats, and stores commodities such as oil, natural gas, and water.

Natural Gas: A fossil fuel consisting of gaseous gas (e.g., methane, ethane, propane, butane) and other heavier, liquids-oriented hydrocarbons (e.g., pentane). Natural gas burns cleaner than oil and coal and is a major source of electricity generation through the use of gas and steam turbines.

Operator: An individual or company responsible for the exploration, production, and development of an oil or gas well.

Precious Metals: Precious metals include gold, silver, palladium, and platinum. These metals have wide industrial uses but are better known for their usage in jewelry, art, and as stores of value.

Upstream: Portion of the energy industry engaged in the exploration, production, and development of crude oil and natural gas reserves.

APPENDIX A

	Hypothetical Institutional Fund (%)	Institutional Fund with 5% Natural Resources (%)
Fixed Income		
Investment Grade Bonds	15.0	15.0
TIPS	9.0	9.0
High Yield Bonds	7.0	7.0
Bank Loans	4.0	4.0
Emerging Market Bonds (local)	5.0	5.0
	40.0	**40.0**
Public Equity		
U.S. Equity	19.0	17.0
Developed Market Equity (non-U.S.)	8.0	7.2
Emerging Market Equity	10.0	9.0
Frontier Market Equity	1.0	0.9
Natural Resources (public)	4.0	3.6
Commodities	3.0	2.7
Infrastructure (public)	3.0	2.7
	48.0	**43.0**
Private Equity/Real Estate		
Private Equity	4.0	4.0
REITs	2.0	2.0
Core Private Real Estate	4.0	4.0
Value-Added Real Estate	1.0	1.0
Opportunistic Real Estate	1.0	1.0
	12.0	**12.0**
Natural Resources		
Oil & Gas	-	2.8
Metals & Mining	-	1.0
Agriculture		0.8
Timber	-	0.5
	-	**5.0**

APPENDIX B

Description of Indices Used in this Paper

S&P 500 Index: U.S. market-cap-weighted stock market index that includes 500 of the top companies in leading industries of the U.S. economy.

S&P 500 Energy Index: A sub-index of the S&P 500 composed of the 31 largest publicly traded energy stocks based in the U.S.

MSCI World Index: An index composed of large- and mid-cap stocks across 23 Developed Markets countries. With 1,643 constituents, the index covers approximately 85% of the free float-adjusted market capitalization in each country.

MSCI World Metals & Mining Index: A sub-index of the MSCI World Index that includes the 40 constituents of the index classified in the Metals & Mining industry (within the Materials sector) according to the Global Industry Classification Standard (GICS®).

NCREIF Row Crop Farmland Index: A quarterly time series composite return of a large pool of individual private market U.S. row crops acquired for investment purposes only.

NCREIF Permanent Crop Farmland Index: A quarterly time series composite return of a large pool of individual private market U.S. permanent crops acquired for investment purposes only.

NCREIF Timber Index: A quarterly time series composite return of a large pool of individual private market U.S. timber properties acquired for investment purposes only.

DISCLAIMERS

This document is for general information and educational purposes only, and must not be considered investment advice or a recommendation that the reader is to engage in, or refrain from taking, a particular investment-related course of action. Any such advice or recommendation must be tailored to your situation and objectives. You should consult all available information, investment, legal, tax and accounting professionals, before making or executing any investment strategy. You must exercise your own independent judgment when making any investment decision.

All information contained in this document is provided "as is," without any representations or warranties of any kind. We disclaim all express and implied warranties including those with respect to accuracy, completeness, timeliness, or fitness for a particular purpose. We assume no responsibility for any losses, whether direct, indirect, special or consequential, which arise out of the use of this presentation.

All investments involve risk. There can be no guarantee that the strategies, tactics, and methods discussed in this document will be successful.

Data contained in this document may be obtained from a variety of sources and may be subject to change. We disclaim any and all liability for such data, including without limitation, any express or implied representations or warranties for information or errors contained in, or omissions from, the information. We shall not be liable for any loss or liability suffered by you resulting from the provision to you of such data or your use or reliance in any way thereon.

Nothing in this document should be interpreted to state or imply that past results are an indication of future performance. Investing involves substantial risk. It is highly unlikely that the past will repeat itself. Selecting an advisor, fund, or strategy based solely on past returns is a poor investment strategy. Past performance does not guarantee future results.