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INVESTING IN AGRICULTURE

AUGUST 2020

Institutional Investing in Agriculture

- More than $100b AUM in Agriculture[1] with $33b in Farmland[2]
- Amount raised in agricultural funds doubled from 2018 to 2019 ($1.8b vs. $3.6b)[2]
- Types of Agriculture investments:

➔ **Public Assets**

- Commodity futures (grains, softs and livestock)
- Agriculture sector equities (*e.g.,* MSCI ACWI Agriculture & Food Chain Index)
- Farmland REITs (operating farms)

➔ **Private Assets**

- **"Farmland Investing"** – Leasing or operating farms ($2.4t US farm real estate, 80% of farm assets[3])
- Debt (Farmland debt ~$375b in 2018, including farmland real estate debt $226b[4])
- Private Equity & Venture Capital Funds (food and Ag tech, food processing and distribution etc.)

1 Global AgInvesting Rankings & Trends Report 2019. 2 2020 Preqin Global Natural Resources Report, 2019; 3 USDA ERS 2018; 4 USDA ERS 2018.

Farmland Investments

- Row (or, annual) crops – *e.g.,* wheat, corn, rice, oats and soybeans
  - Typically farms are leased for fixed rents
  - Investors can directly have economic exposures to crop prices via futures markets
  - About 62% of farmland properties in NCREIF (National Council of Real Estate Investment Fiduciaries)
- Permanent (or perennial) crops – *e.g.,* pistachios, almonds, cherries, grapes, and oranges
  - Typically farms are directly operated
  - Unlike row crops economic exposure to permanent crops is not widely available via futures markets
  - About 38% of farmland properties in NCREIF
- Livestock – Land is leased to an operator for grazing or livestock ownership
- Developmental Land – NCREIF Farmland index does not include such greenfield properties
  - Including such properties may lower asset class performance due to J-curve

➔ **We will focus on US Farmland and discuss differences between row and permanent crops**

Source: NCREIF, Datastream and PGIM IAS

Row *vs.* Permanent Crops

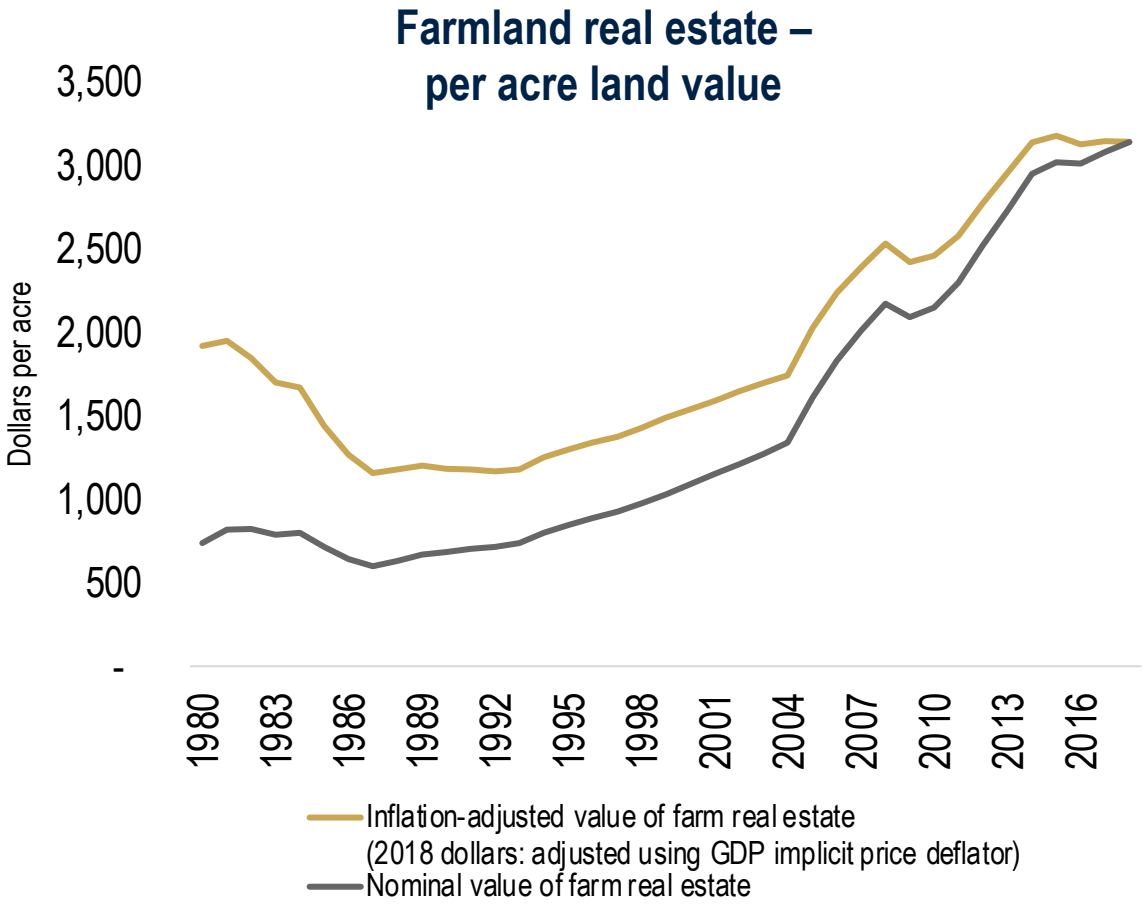
- Row crops – investors lease land to farmers
  - Lease terms are typically 2-3y
  - Rents are fixed but they fluctuate long term with the broader commodity cycle
  - Investors bear the risk that farmers miss rental payments
  - Periodic need for capital expenditures (drainage, soil enrichment and irrigation)

- Permanent crops – investors own and operate the land
  - It can take 5y or longer for a plant to be productive, land may be "in development"
  - Have a J-curve return profile due to upfront development costs
  - are less sensitive to broad commodity cycle, but have other risks (*e.g.,* specific commodity risk)

- Permanent crop yields are usually higher than row crops
  - But permanent crop yields depend on plant maturity and are relatively more variable
  - Permanent crop require active farm management (applying technology and managerial skill)

Components of Farmland Returns

- Decomposing long-term US Farmland Total Returns (US annual rate)
  - **Total Factor Productivity** (TFP = 1.4%/y)[1]
    - Total farm output (1.5%)
    - Total farm input (0.1%) (labor inputs (-0.5%) offset by intermediate goods input (0.6%))
  - **Commodity Returns** (CR = 2.2%/y)[2]
  - **Land Value Appreciation** (LVA = 4.6%/y)[3]
  - **Farmland Total Return:**
    8.2%/y = TFP (1.4%/y) + CR (2.2%/y) + LVA (4.6%/y)
- Farmland has relatively high current net income
  - row crops 2%-4%;
  - permanent crops 6%-9%



Past performance is not a reliable indicator of future results. 1 Source: USDA 1948 – 2015. 2 Source: A. Levine, Y. H. Ooi, M. Richardson, and C. Sasseville, "Commodities for the Long Run," *Financial Analysts Journal*, 74:2, 55-68. Long term commodity returns based on grain futures returns from 1946 – 2015. 3 USDA ERS 2018, since 1980 Nominal per annum growth rate in value of farm real estate.

Farmland Performance

- Highest risk-adjusted returns in the real asset category (*Sharpe ratio of 1.6 from Jan96 – Jun20)*[1]

- Resilient during economic downturns
  - One of the few asset classes to have positive total returns in 2008 (15.8%)

- 1y total returns as of Q2 2020:
  - Permanent Crops: 3.5% (5.6% income and -2.1% price return)
  - Row Crops: 3.4% (3.6% income and -0.2% price return)
  - Regional differences exist (*e.g.,* for permanent corps – Pacific West 3.5% *vs.* Southeast 12.6%*)*

- Farmland portfolios should be diverse to control specific risks:
  - Trade policies (*e.g.,* China tariffs on US impacted soybeans (2019) and China tariffs on Australia impacted oats (2020))
  - Pandemic lockdown (OJ prices higher from health demand but cotton prices lower from factory shutdowns

Past performance is not a reliable indicator of future results. 1 For comparative real asset returns see H. Parikh and W. Zhang, "The Diversity of Real Assets: Portfolio Construction for Institutional Investors," *PGIM*, June 2019.
Source: NCREIF and PGIM IAS

Farmland's Macroeconomic Sensitivities – Using RASA™

- Both row and permanent crops had negative, but not statistically significant, exposure to growth (growth betas of -0.37 and -1.2, respectively)
  - Permanent crops had negative and significant exposure to growth surprise (-4.98)
  - Row crops, not as countercyclical possibly

- Row crops had statistically significant and higher exposure to the inflation level and inflation surprise (inflation betas of 1.6 and 2.5, respectively)

Betas	Inflation Level	Inflation Surprise	Growth Level	Growth Surprise
Farmland	0.67	0.94	-0.50	**-2.67**
Row Crops	**1.60**	**2.45**	-0.37	1.18
Permanent Crops	-0.96	-0.54	-1.20	**-4.98**

Notes: January 1996 – June 2017 Period. Returns for each are regressed on inflation and real GDP levels (QoQ). We also regress asset returns on inflation and GDP surprises. The beta is a sum of the lead, current, and lag betas (*i.e.,* Dimson beta). Betas in bold suggests significance at a 90% confidence level. See appendix for asset class proxies. Source: PGIM IAS, see H. Parikh and W. Zhang, "The Diversity of Real Assets: Portfolio Construction for Institutional Investors," PGIM, June 2019.

Farmland's Stock & Bond Sensitivities – Using RASA™

- Farmland beta to US equities was 0.02 – low sensitivity to stocks
- Also, farmland beta to US 10y Treasury was -0.01 – low sensitivity to bonds
- Regression explanatory power (R^2) was only 0.05 – low correlation to stocks & bonds

➔ **Farmland is a potentially diversifying asset class for institutional portfolios**

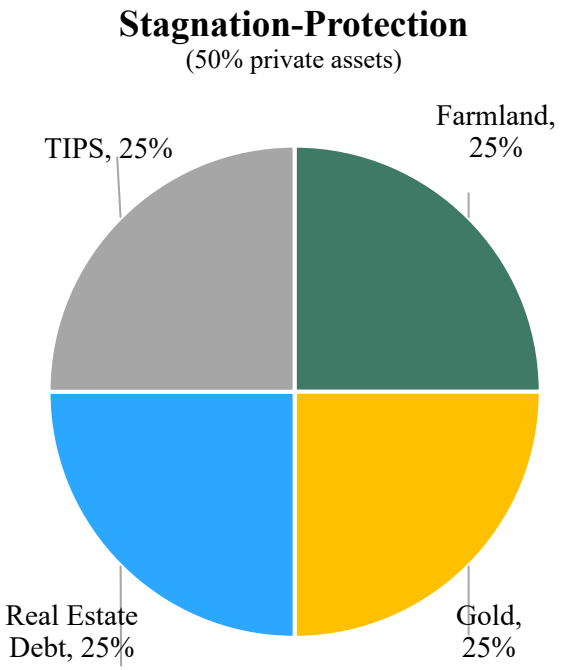
Betas	US Equity	US 10y Treasury	R^2
Farmland	0.02	-0.01	0.05
Row Crops	0.02	-0.08	0.04
Permanent Crops	0.00	-0.15	0.09

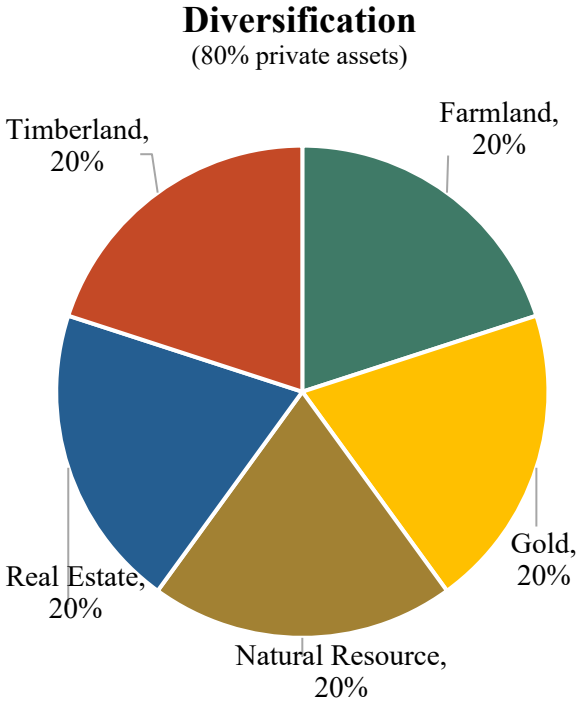
Notes: January 1996 – June 2017 Period. Returns for each are regressed on inflation and real GDP levels (QoQ). We also regress asset returns on inflation and GDP surprises. The beta is a sum of the lead, current, and lag betas (*i.e.,* Dimson beta). Betas in bold suggests significance at a 90% confidence level. See appendix for asset class proxies. Source: PGIM IAS, see H. Parikh and W. Zhang, "The Diversity of Real Assets: Portfolio Construction for Institutional Investors," PGIM, June 2019.

RASA Real Asset Strategy Portfolios with Farmland

- **For Stagnation Protection**
  - Assets with low growth level and surprise betas
  - Farmland, gold, real estate debt, and TIPS

- **For Portfolio Diversification**
  - Assets with low correlation with stock and bond returns
  - Farmland, gold, natural resources, equity real estate, and timberland





Note: For Illustration Purposes Only. See Appendix for asset class proxies. Source: PGIM IAS, see H. Parikh and W. Zhang, "The Diversity of Real Assets: Portfolio Construction for Institutional Investors," PGIM, June 2019.

Why Invest in U.S. Farmland?

Competitive Advantages of the U.S. Farm

Optimal Geographic Conditions

The U.S. has extensive farm areas with favorable and diverse climatic and soil conditions to produce major annual row crops (*i.e.,* grains, vegetables) and permanent crops (*i.e.,* nuts, citrus, wine grapes).

Highly Developed Infrastructure

Transportation infrastructure is a key variable in the movement of farm goods. The U.S. relies on one of the most advanced networks of highways, railroads, and seaports strategically located around the country.

Well Capitalized Farm Economy

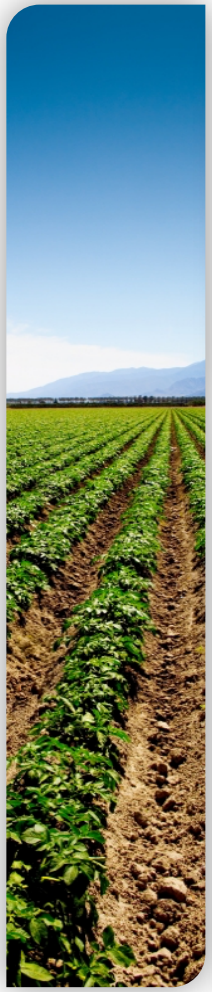
Major private and government sponsored financial institutions provide consistent real estate and non-real estate capital to the farm sector.

Advanced Farm Technology

Growth in farm productivity has been driven by research supported by the government sector (*i.e.,* USDA, agricultural extension programs, public universities) as well as the private sector (*i.e.,* seed suppliers).

Large Domestic Market & Global Export Powerhouse

Increasing global demand for healthy and nutritious food products coupled with improved incomes and expanding diets will continue benefitting the U.S. farm sector.



Leading Producer Of Key Agricultural Commodities

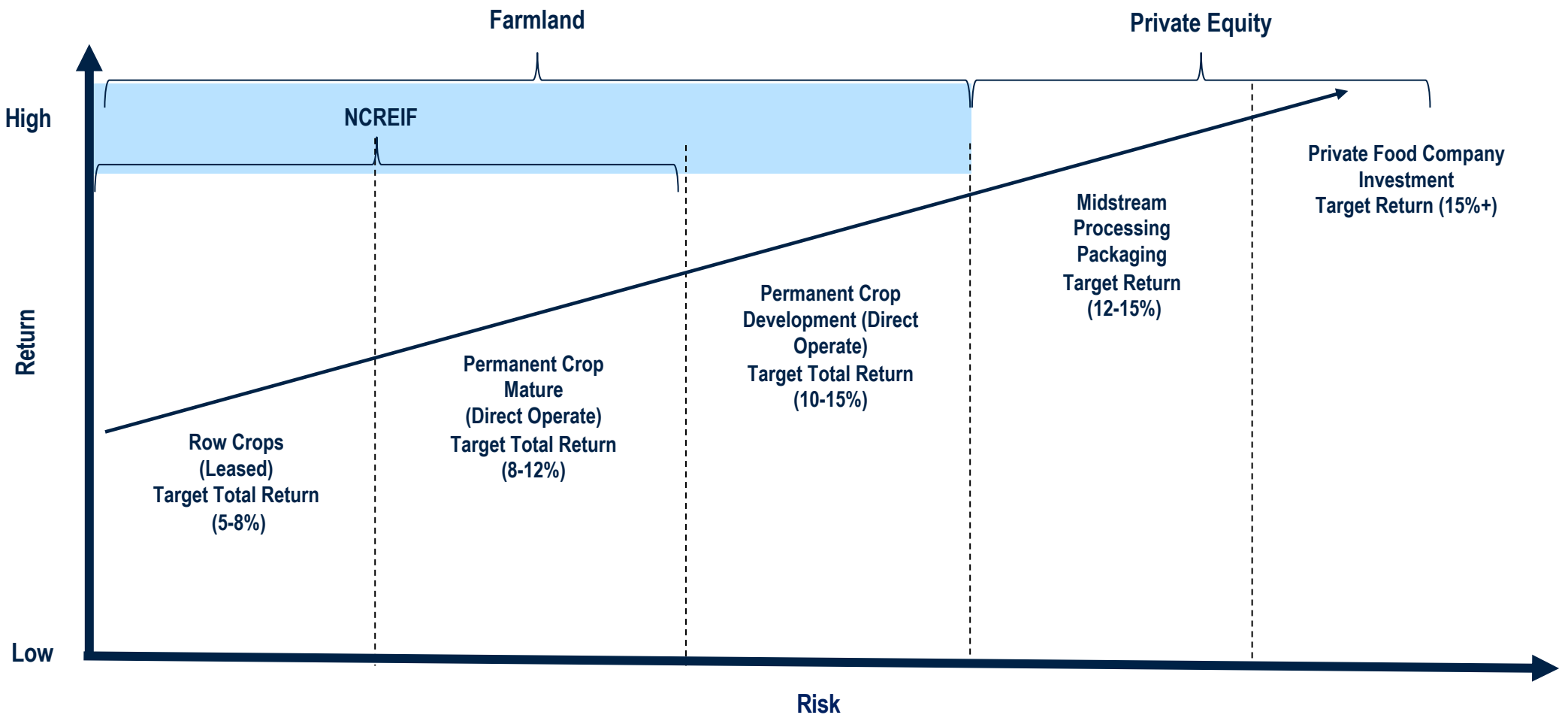
- US is the leading producer of some of the world's most important commodities
- Number one producer of common and highly consumed grains (Corn and Soybeans), and some of the highest valued products (Almonds and Pistachios)
- A high diversity of both climates and soils allows the US to produce a wide variety of crops
- Consequently, the US is a top exporter across many row crops and permanent plantings
- The low per-unit production cost of several large commodities allows the U.S. to maintain a sustainable competitive advantage in agriculture

US Ranking Of Selected Commodities in Terms of Production and Exports

	2019/20 Production (million metric tons)				2019/20 Exports
	Rank	U.S.	World	U.S. (%)	Rank
Corn	1	347.8	1,111.6	31.3%	1
Soybeans	2	96.9	339.4	28.5%	2
Wheat	6	52.3	763.9	6.8%	3
Cotton	3	20.1	121.3	16.6%	1
Almonds	1	1.0	1.3	77.3%	1
Pistachios	1	0.3	0.7	57.3%	1
Walnuts	2	0.6	2.1	26.9%	1
Orange Juice	2	0.3	1.7	19.2%	5
Apples	3	4.7	75.7	6.2%	3
Fresh Oranges	4	4.9	47.5	10.3%	3
Table Grapes	6	1.0	23.4	4.3%	3

Info based on 2019/20 Projections. There is no guarantee that the projections shown would be achieved. Sources: Foreign Agricultural Service USDA, PAI Research.

Institutional Agriculture Investment Spectrum



Note: All returns referenced herein are estimated annualized gross real returns over a complete market cycle before any property management and portfolio management fees. Note that returns are unlevered and subject to change. Targeted net returns are expected to be based on 100 bps for portfolio management fees. Property management fees and hurdle targets are not assumed in the net returns as this will be different for each investor. **Target returns cannot be guaranteed**. Sources: PAI Research. Provided for illustrative purposes only.

Farmland Portfolio Structuring

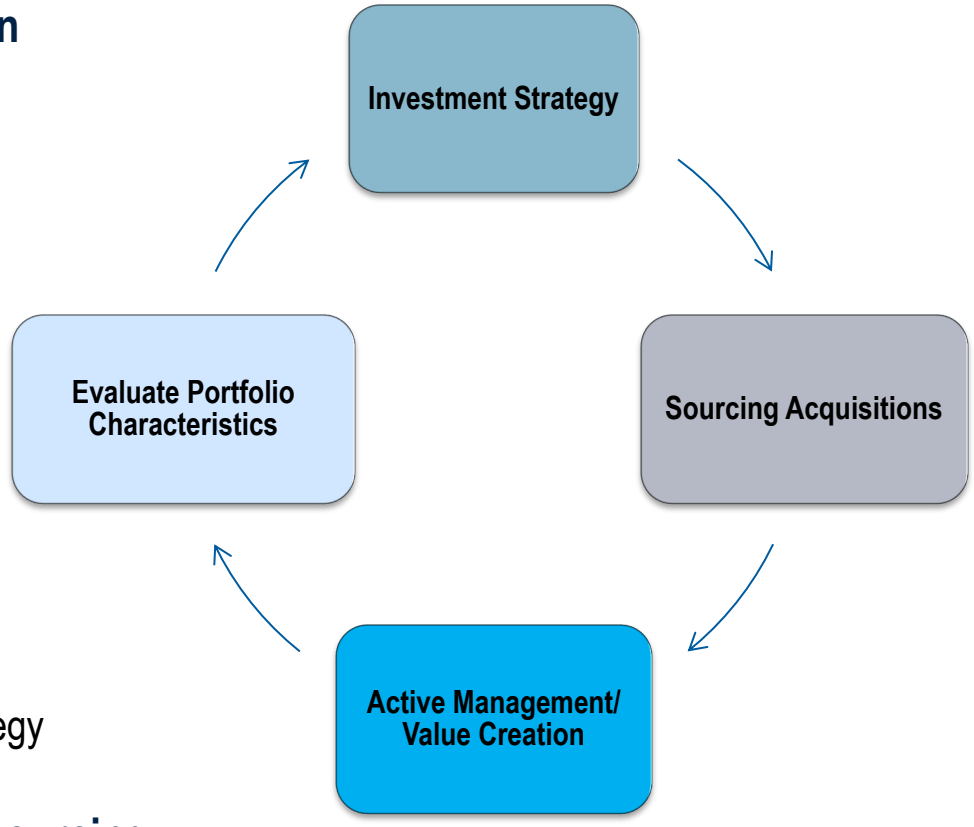
- **Client return objectives and risk tolerances guide portfolio construction**

- **Portfolio construction considers various factors:**
  - Income (cash flow) and Appreciation Contribution
  - Total Return
  - Inflation Hedging
  - Diversity

- **Portfolios can include multiple strategies and management styles**
  - Property Type and Sub-types – Row Crop vs. Permanent Crop
  - Operation Type – Lease vs. Direct Operation
  - Investment Stage – Mature, Development, Re-development
  - Diversification – Geographic and Commodity guidelines based on investment strategy

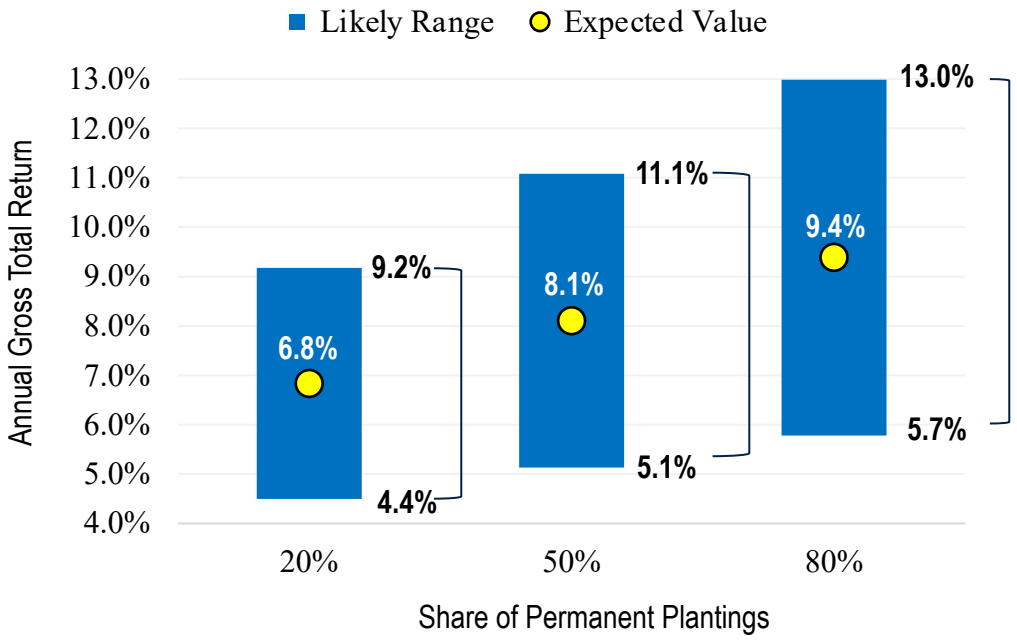
- **Portfolio implementation is highly dependent on available assets and sourcing capabilities**

- **Given the lumpiness of the asset class, portfolio construction is an iterative process considering recent acquisitions and potential dispositions**



Sample Institutional Farmland Portfolios

	Row Crops		Permanent
	Corn Belt	Delta	Western/ Eastern
Portfolio 1	40%	40%	20%
Portfolio 2	25%	25%	50%
Portfolio 3	10%	10%	80%



Desired outcome:

Portfolio 1

- 80% Row Crop and 20% Permanent Planting strategy is expected to produce a 6.8% gross total return with a range of 4.4% to 9.2%

Portfolio 2

- 50% Row Crop and 50% Permanent Planting strategy is expected to produce a 8.1% gross total return with a range of 5.1% to 11.1%

Portfolio 3

- 20% Row Crop and 80% Permanent Planting strategy is expected to produce a 9.4% gross total return with a range of 5.7% to 13.0%

Note: Expected returns is based on current PAI return assumptions for Row Crops and Permanent Crops. The implied volatility range is based on the standard deviation of NCREIF Farmland Performance returns from 1992-2019. All returns referenced herein are estimated annualized gross real returns over a complete market cycle before any portfolio management fees but inclusive of property level management fees. Note that returns are unlevered and subject to change. Targeted net returns are expected to be based on 100 bps for portfolio management fees. Target returns cannot be guaranteed. Sources: PAI Research. Provided for illustrative purposes only.

Risk Management for Farmland Portfolios

- **Portfolio Level:**

  Portfolio diversification is typically provided across key dimensions:

  - **Property Type** - Permanent Plantings and Row Crops will be balanced to create a risk/return profile to meet client objectives
  - **Crop Type** - The portfolio will be planted across multiple crop types to manage market risk
  - **Geographic Location** - Properties will be well diversified from a geographical standpoint to reduce weather risk (flood, frost, hailstorm, extreme warm weather) in the portfolio
  - **Investment Stage** - Redevelopment, developments, mature cash flowing properties are typically balanced to create stability of cash flow

- **Property Level:**

  Property specific risk is managed across key dimensions:

  - **Acquisition Due Diligence** - PAI conducts a rigorous due diligence process during the investment selection process to evaluate every aspect of the investments (soil analysis, water quality and quantity, boundary lines easements, environment site assessments, etc.)
  - **Direct Management** - Active management of direct operated properties by Prudential Financial, Inc. (PFI)* Farm management team to implement horticultural programs to maximize yield. Team also would design and lead implementation of both tree pest and disease control programs if necessary
  - **Water** - Irrigated properties will typically have at least two water sources (ground water and surface water)
  - **Insurance** - Verify that all direct managed assets have adequate property, liability, and crop insurance coverage (if available)

*PFI of the United States is not affiliated in any manner with Prudential plc, incorporated in the United Kingdom, or with Prudential Assurance Company, a subsidiary of M&G plc, incorporated in the United Kingdom.

ESG Initiatives

- **ESG initiatives are important to PFI and are incorporated in our investment process. We understand the importance our clients place on them**

- **Member of Leading Harvest Sustainability Standard**
  - Working on assurance plan with testing of selected properties on 14 key sustainable principles from soil health, to water management, energy usage, air quality conservation, and community interaction, as well as compliance with labor laws and regulations

- **Examples of current property level initiatives with agricultural best management practices that are implemented where appropriate are:**
  - Use of Surface water vs. aquifer
  - Lower pressure valves on irrigation pivots
  - Water efficient irrigation systems on permanent crops (i.e. microjet)
  - Water meters on irrigation wells
  - Conversion of power units from diesel to natural gas, electric or solar
  - Maintaining shallow surface water on field after harvest to provide habitat for migrating waterfowl where appropriate
  - Grid soil sampling to apply optimal fertilization (example of precision farming in permanent crops)
  - Participation in Conservation Reserve program, Wetlands Reserve program, and Environmental Quality Incentives program when and where applicable
  - Implementation of the USDA's Good Agricultural Practices (GAP) for the fruit and vegetable crops to minimize risk of contamination
  - Integrated Pest Management (*i.e.,* create habitats for natural predators like owls to reduce reliance on pest control)
  - Precision farming for row crops using GPS

- **Tenants and on-site managers have duties and responsibilities under lease or management agreements that include the compliance at all times, with all federal, state and local rules, regulations, guidelines, statutes, laws, and ordinance**

- **PGIM Real Estate is a signatory of the United Nations backed Principles for Responsible Investment**

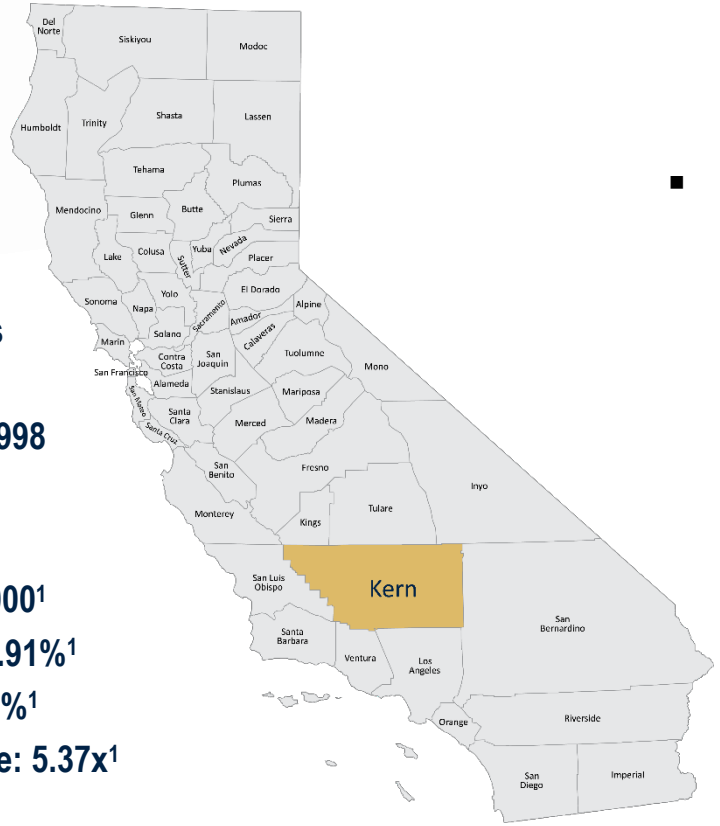
Examples of Implementing Best Practices in the Field

Sensor Technologies	
Pest management	▪ Mating disruption technology to implement pheromone program to manage and control insect pest populations ▪ Reduces the use of pesticides
Frost protection	▪ Wind machines and overhead sprinklers used to protect crops from damage related to cold temperatures
Irrigation	▪ Precision soil moisture monitoring for irrigation management to improve plant health, reduce irrigation costs, and enhance yields

Environmental Awareness	
Air Quality	▪ No tillage in most permanent plantings and prunings are chipped and used as mulch
Fertigation and Containment	▪ Technique used to allow the fertilizer to be dissolved and distributed with the water in the irrigation system which 1) controls application of nutrients and water, 2) minimizes leaching and negative environmental impacts, and 3) reduces fertilizer inputs thus reducing production costs. Further, we utilize fertilizer containment structures and tanks to safeguard against spillage
Clean Energy	▪ Conversion of diesel to electric or solar energy

Energy Efficiency	
Variable Frequency Drive	▪ Improve the efficiency of irrigation pumps by reducing the energy requirements by using control methods such as variable speed drive
Solar Panels	▪ Solar used to offset electrical power usage

Case Study – Pistachio Property



Primary Commodity: Pistachios
Acres (Gross/Tillable): 981/695
Acquisition Date: October 16, 1998
Purchase Price: $10,147,000
Total Investment: $10,969,022[1]
Current Market Value: $24,550,000[1]
Gross Inception to date IRR: 15.91%[1]
Net Inception to date IRR: 15.10%[1]
Inception to date Equity Multiple: 5.37x[1]

Investment Description

- Kern County Property is a 981 acre irrigated pistachio property located in the Southern Central Valley of California. The property was planted mainly in 1990 and is the best performing property in the portfolio for PAI's institutional investor.
- This property is located in one of the premier growing areas for pistachios and is in close proximity to processors. The property is irrigated with surface water and experienced no water availability disruption during the historic California drought. Historically, the property has experienced strong pistachio production over the long term and has provided exceptional total returns to the investor. The annualized 10 year gross and net NCREIF total return for this property is approximately 26.74% and 25.74% respectively, as of 12/31/19.

This investment illustrates PFI's experience with sourcing quality permanent planting properties that continues to produce outstanding yields. On average, this orchard has produced over 3,200 lbs. per acre the last six years.

Note: Past performance is not a guarantee or a reliable indicator of future results.
1 Figures as of 12/31/19

IAS Real Asset Research Program

Real Asset Blogs

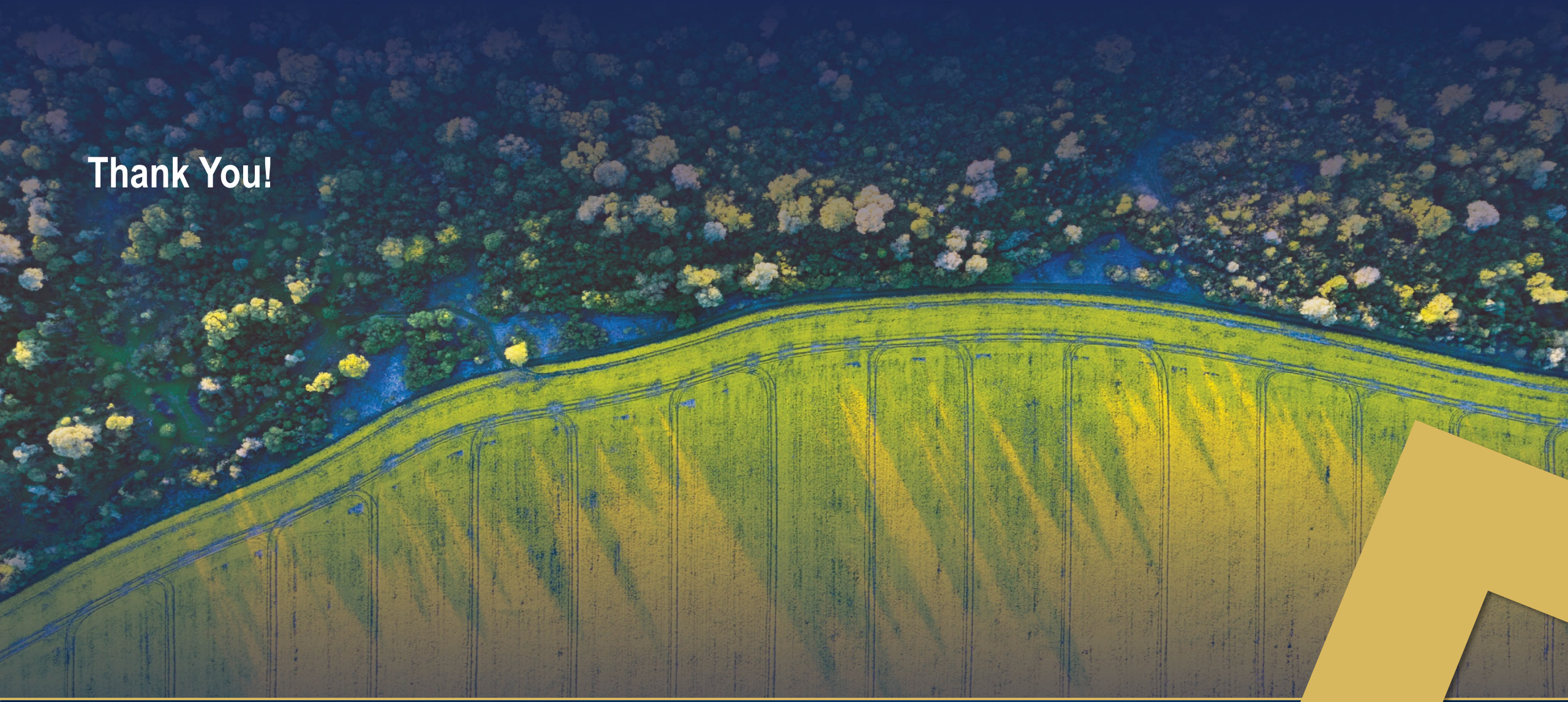
How The Coronavirus Pandemic Highlights The Diversity In Real Assets (4/30/2020)

Spot Gold and Gold Miners Are NOT Two Sides of the Same Coin (5/21/2020)

Market Volatility Has Declined – Is There a Case for Investing in Gold? (6/8/2020)

Customize Benchmarks to Fit Investors' Investment Objectives, Not the Other Way Around (7/10/2020)

Opportunities in Sustainable Farming Practices (8/3/2020)



Thank You!

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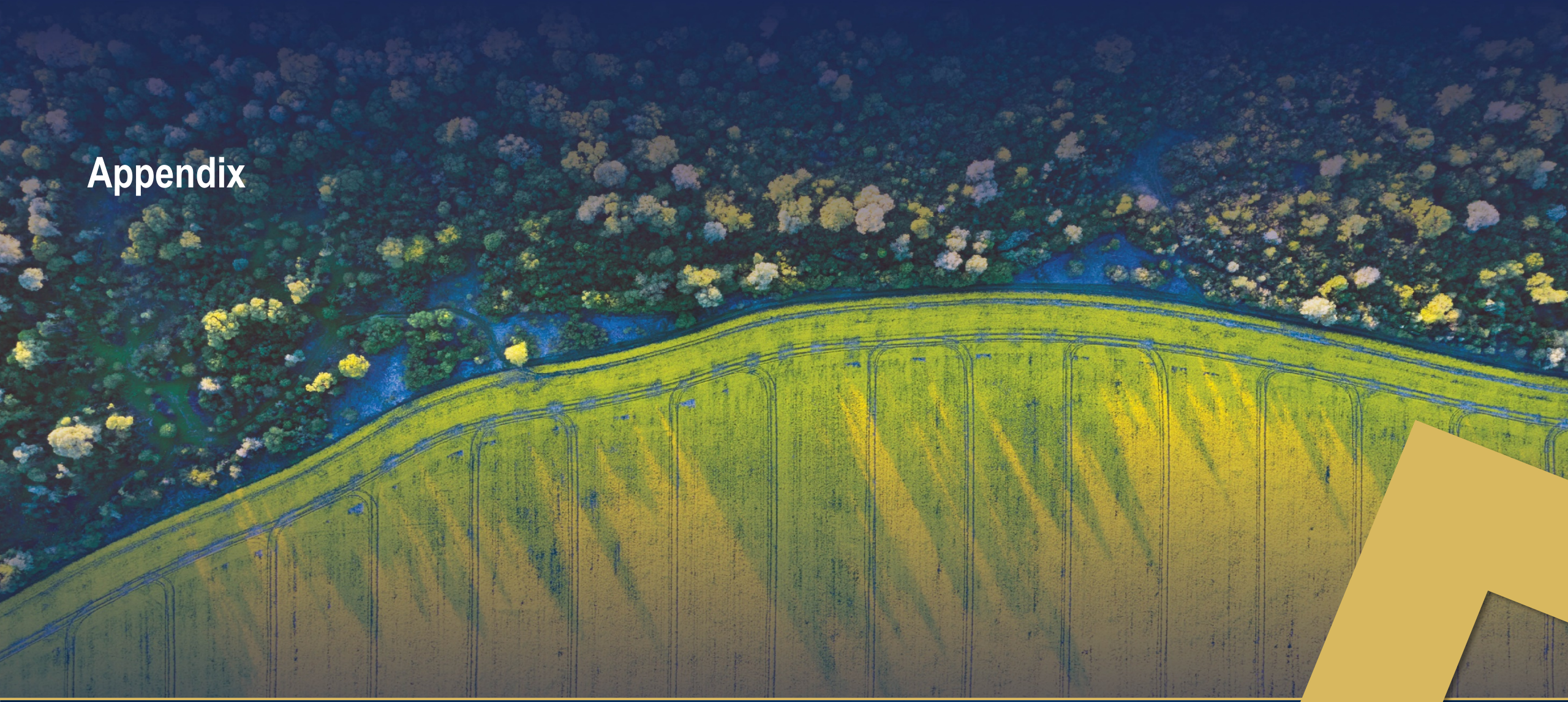
INVESTING IN AGRICULTURE

AUGUST 2020

Appendix



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INVESTING IN AGRICULTURE

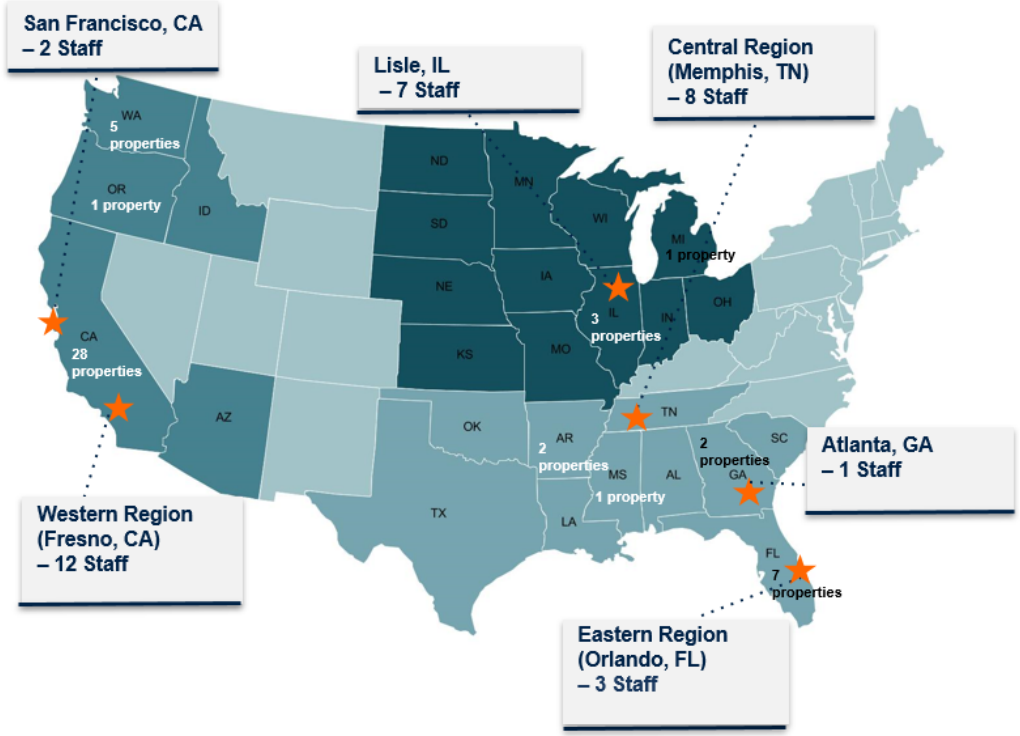
AUGUST 2020

Appendix – Real Asset Class Indices and Sources

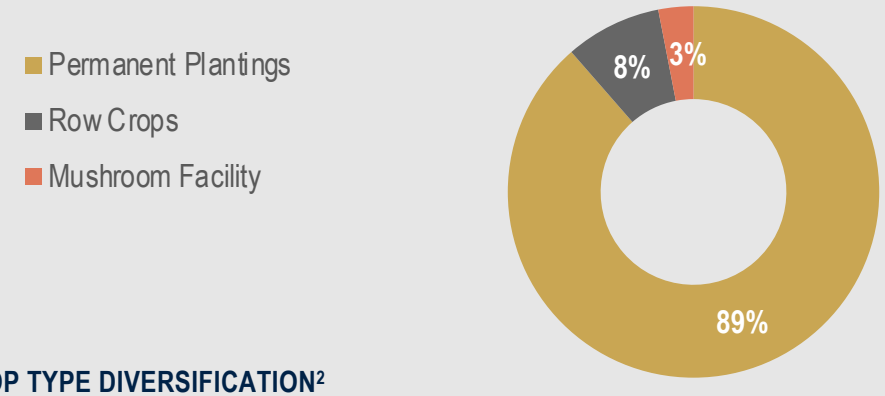
Asset Class	Index	Source
Farmland	NCREIF Farmland total returns index – is a quarterly time series composite return measure of investment performance of a large pool of individual farmland properties acquired in the private market for investment purposes only.	NCREIF
Timberland	NCREIF Timberland total returns index – is a quarterly time series composite return measure of investment performance of a large pool of individual U.S. timber properties acquired in the private market for investment purposes only.	NCREIF
Infrastructure	US All vintage pooled funds time weighted rate of returns	Burgiss
Natural Resources	US All vintage pooled funds time weighted rate of returns	Burgiss
Equity Real Estate	*60% in NCREIF ODCE total returns index* – The NFI-ODCE is a capitalization-weighted, gross of fee, time-weighted return index. Open-end funds are generally defined as infinite-life vehicles consisting of multiple investors who have the ability to enter or exit the fund on a periodic basis, subject to contribution and/or redemption requests, thereby providing a degree of potential investment liquidity. *20% in Value Add and 20% in Opportunistic* - US All vintage pooled funds time weighted rate of returns	NCREIF, Burgiss
Real Estate Debt	Commercial Mortgage Performance total returns index – The Giliberto-Levy Commercial Mortgage Performance Index measures the investment performance of select private-market investments in commercial real estate debt. Specifically, the Index tracks fixed-rate, fixed-term senior loans that are made by and held in the investment portfolios ("on balance sheet") of institutional lenders such as life insurance companies and pension funds.	Giliberto-Levy
TIPS	Bloomberg-Barclays US TIPS All Maturity total returns index – The index measures the performance of the U.S. treasury inflation-linked bond market. The US TIPS index spliced with Pond and Mirani [2009] TIPS performance prior to April 1997	Bloomberg, Datastream
Gold	Gold Bullion LBM U$/Troy Ounce price returns index	Datastream

PGIM Agricultural Finance & Investments Overview

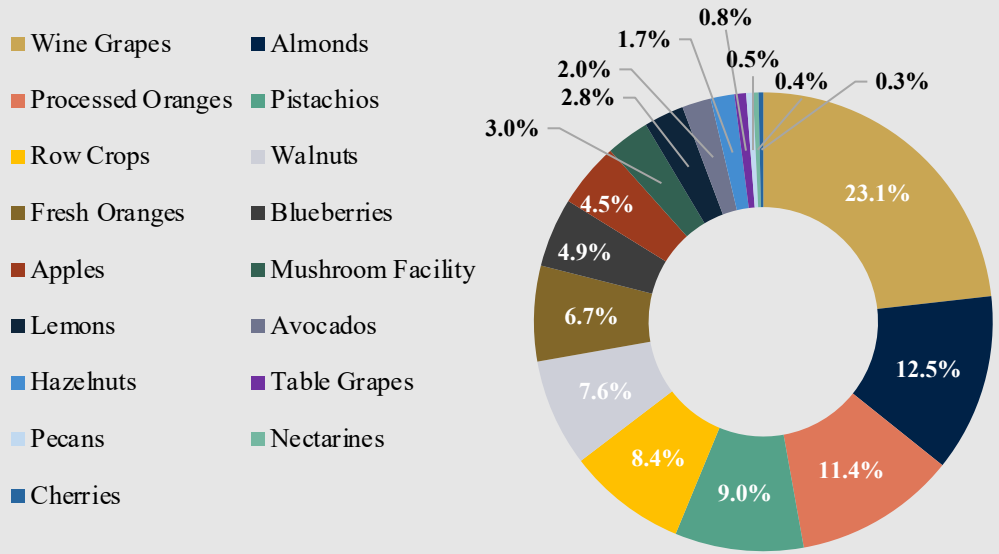
- $1.7 Billion in Assets under Management/Administration as of 2/28/20[1]
- 158,640 Acres under Management
- 33 Dedicated Professionals
- 1989 – Began investing on behalf of 3rd Party Institutional Capital
- Positioned for Growth



PROPERTY TYPE DIVERSIFICATION[2]



CROP TYPE DIVERSIFICATION[2]



1 $1.7 billion in AUM/AUA represents $1.2 billion in net farmland assets on behalf of four single account clients, one partnership between PFI's proprietary account and a Public Pension Fund and $460.2 million on behalf of various absentee landowners, high net worth individuals, and bank trust departments. 2 As of February 28, 2020

NOTES TO DISCLOSURE

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Index Descriptions

NCREIF Farmland Index: The NCREIF Farmland Index is a quarterly time series composite return measure of investment performance of a large pool of individual agricultural properties acquired in the private market for investment purposes only. All properties in the Farmland Index have been acquired, at least in part, on behalf of tax-exempt institutional investors - the great majority being pension funds. As such, all properties are held in a fiduciary environment. Reinvestment of dividends is not applicable to this asset class. Note: A benchmark Index is not professionally managed, does not have a defined investment objective, and does not incur fees or expenses. Investors cannot invest directly in an index. Source of the Benchmark: NCREIF - National Council of Real Estate Investment Fiduciaries.