Enhancing Sustainability Data and Reporting: a proof of concept for Australian agriculture.

NATURAL AND SOCIAL CAPITAL ASSESSMENT SCOPE

AUSTRALIAN COTTON SUSTAINABILITY FRAMEWORK

PLANET. PEOPLE. PADDOCK.

COTTON AUSTRALIA

CRDC
COTTON RESEARCH AND DEVELOPMENT CORPORATION

BACKGROUND

The Australian cotton industry is working on an ambitious project to significantly enhance its already sound sustainability data collection and reporting to:

- Develop a framework with indicators that are aligned to major current and emerging market-based sustainability standards
- Identify cost-effective and robust data sources for indicator gaps
- Use the enhanced data to explore if the industry can:
  - Create industry-scale natural and social capital assessments (this work is the focus of this paper)
  - Set Science Based Targets
  - Produce annual integrated reports to more clearly communicate the links and trade-offs between natural, social, and financial capital
  - Give stakeholders inside and outside the cotton industry better access to the data they need.

SCALABILITY

The project is designed to be scalable and repeatable across all industries; it will provide a proof-of-concept for other Australian agricultural sustainability frameworks.

- Progress and learnings from the project will be regularly shared with other industries, so we can work towards consistent indicators, credible and robust reporting, and increased awareness and support from our farmers
- Decisions and assumptions will be documented to provide consistency for future assessments by cotton and other industries, and to provide defensible justifications of decisions.

STAKEHOLDER FEEDBACK

These slides and supporting documents were shared at natural and social capital working group (coordinated via the Australian Agriculture Sustainability Framework community of practice) meetings held on 6 and 10 November 2023. Key questions and feedback are highlighted in yellow on relevant slides.

NATURAL & SOCIAL CAPITAL ASSESSMENT PROCESS

A capital is the stock of an asset that combines to yield a flow of benefits or “services” to people. Businesses rely heavily on natural, human, social, produced and financial capital. For that reason, they are referred to as dependencies. To a greater or lesser extent, all businesses also have an impact on natural, human, and social capital with every action they take. A capitals assessment helps businesses understand, measure and value their relation to nature and society in order to make better informed decisions and create future-proof businesses.

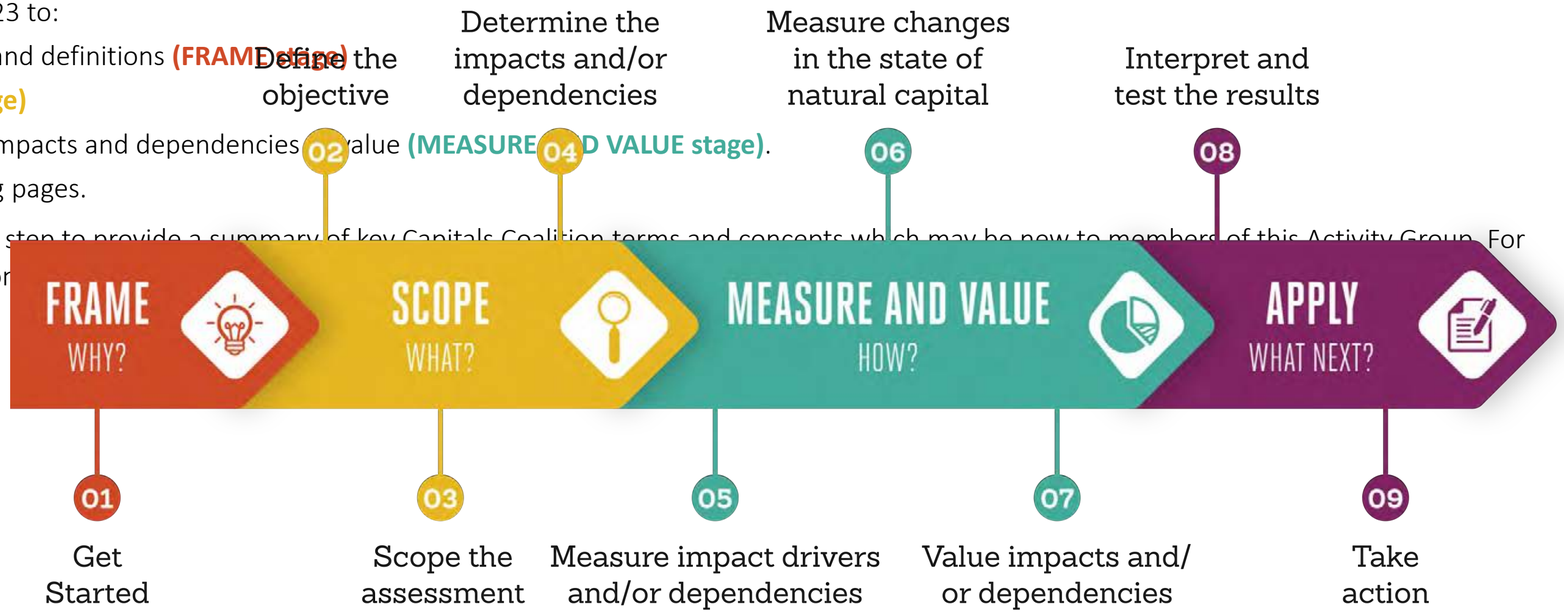
The Australian cotton industry and Queensland Department of Agriculture and Fisheries (QDAF) are working together to attempt to apply recognised methods to create industry scale natural and social capital assessments. This work follows guidance provided by the Capitals Coalition, a multi-stakeholder organisation recognised as leading the global effort to have the value of all capitals included in decision-making.

A project inception meeting was held on 23 June 2023 to:

- Achieve a common understanding of key concepts and definitions **(FRAME stage)**
- Agree and document the project scope **(SCOPE stage)**
- Preliminary agreement on priority cotton industry impacts and dependencies to value **(MEASURE AND VALUE stage)**.

A summary of the meeting output is on the following pages.

Also included is additional brief background for each step to provide a summary of key Capitals Coalition terms and concepts which may be new to members of this Activity Group. For more detailed guidance, refer to the Capitals Coalition



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CONTEXT

Australian cotton is grown on up to 1,500 farms in more than 150 regional communities. Cotton is grown mainly on family farms in inland eastern Australia, and starting to be grown in northern Australia in new areas being developed for sustainable cropping. After picking, cotton is sent to a gin where lint is separated from seeds. There are no spinning mills in Australia; all lint is exported.

In the 1990s, the Australian cotton industry gained a reputation for excessive water and pesticide use. Sustained and coordinated investment in the industry since then, including becoming the first Australian agricultural industry to independently assess its environmental impacts in 1991, has seen long trends of improvement in many sustainability areas.

The industry wants to continue its work to build customer and community trust in the industry, and provide cotton growers with evidence to help them assess if they can make changes to improve their sustainability. This natural and social capital assessment is one tool to do this.

The assessment boundary is Australian cotton farms.

INTENDED APPLICATION OF NATURAL AND SOCIAL CAPITAL ASSESSMENT

The purpose of this work is to communicate internally and externally for two reasons:

Provide more insightful data to improve decision-making for growers (giving them the confidence to adopt practices that create both economic and natural value); our wider stakeholders (giving them better contextual information to inform decisions on buying Australian cotton); and the cotton industry itself (enhancing our ability to monitor progress and allocate resources)

Contribute to a scientifically robust alternative to the EU's Product Environmental Footprint to demonstrate sustainability of Australian food and fibre.

Summary Concepts

1.1 THE FOUNDATIONAL CONCEPTS OF NATURAL, HUMAN, SOCIAL, AND PRODUCED CAPITALS

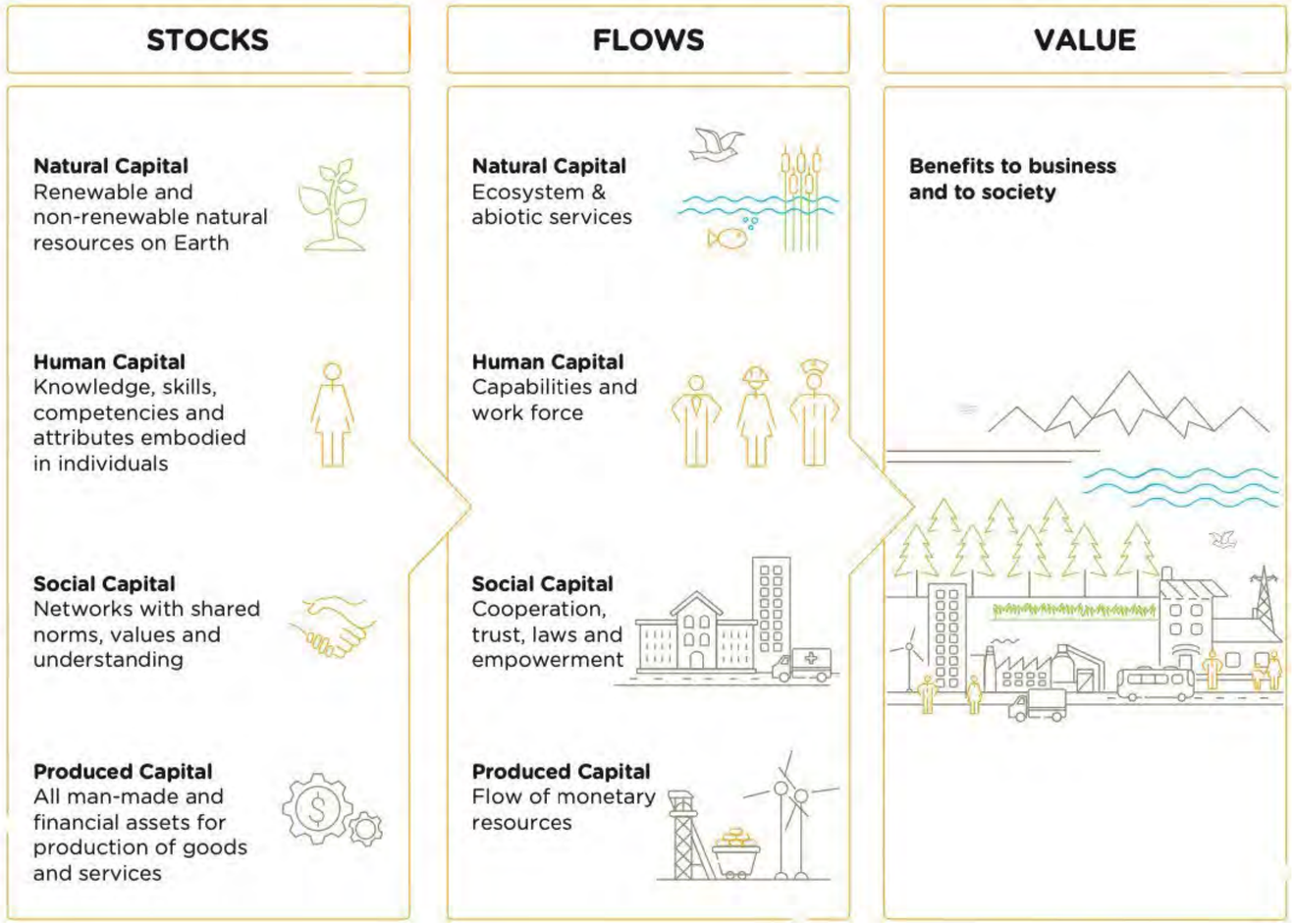
A capital is the stock of an asset that combines to yield a flow of benefits or "services" to people. When invested in and managed responsibly, the asset creates value. If we "draw down" on the capital stock itself we limit its ability to provide value to people and the economy, and if we degrade it too much, it can stop providing value all together.

Although many things can be considered as a capital stock[1], there are four that are commonly used: natural, human, social, and produced. Businesses depend on all these capitals. For that reason, they are referred to as **dependencies**.

To a greater or lesser extent, all businesses also have an impact on natural, human, and social capital with every action they take. This impact can be direct and indirect, positive, and negative. Capitals can also be affected by social and economic changes outside the control of the business.
These are referred to as **impacts**.

A capitals assessment helps businesses understand, measure and value their relation to nature and society in order to make better informed decisions and create future-proof businesses.

[1] For example, the Integrated Reporting <IR> framework is structured on 6 capitals – Natural, Human, Social, Intellectual, Manufactured and Financial. (So is my young adult sustainability novel.)



*"Capital" is another term for the "**stock**" of resources that combine to yield a "**flow**" of benefits to people and nature.*

Summary Concepts

ASSESSMENT V ACCOUNTING

Natural capital accounting is measuring and valuing change in stocks (extent and condition of natural capital). The System of Environmental Economic Accounting (SEEA) is the global standard for this.

Natural (and social) capital assessment is measuring and valuing change in impacts and dependencies. The Capitals Coalition methodology is the global standard for this.

The cotton industry will be collecting data for stocks, impacts and dependencies as part of its revamped data framework. So, technically, we could produce a capitals assessment and account. We may still do this. But we are focusing on an "assessment" initially for three reasons:

We aren't confident the industry-scale data will be accurate enough to provide the level of precision an "account" implies

The language of impacts and dependencies is common in new sustainability initiatives like the Taskforce for Nature-related Financial Disclosures and the European Sustainability Reporting Standards (which also requires double materiality – which is achieved via a capitals assessment process).

An account results in an environmental or social profit and loss and balance sheet statement. We're not convinced this format would be conducive to catalysing change. Instead, we want to apply behavioural science and good design to create a natural and social capital assessment format that compels people to look at it, to use it, and to be motivated to improve – in the same way gym apps or social media analytics encourage users to see how they're going and compete with themselves to do better.

FRAME
WHY?

Summary Concepts

STOCKS (assets)

EXTENT (how much) — **CONDITION** (quality)

ACCOUNT

FLOWS

DEPENDENCIES (services) — **IMPACTS**

ASSESSMENT

VALUE

(cost or benefits from change in stocks, dependencies or impacts to business or society)

Regardless of whether an account or assessment is undertaken, it's important to note this industry scale work aims to use publicly-available, industry scale data. It's not perfect, but it's cheap and it's repeatable and good enough to be able to tell a story at industry scale. We call this information grade data, as opposed to what we call the investment grade data an individual farm business would need to participate in carbon or biodiversity markets, or to have the certainty needed to make a major investment on change of land use.

Our hope is we can agree on nationally consistent indicators and valuation methods, and that users can choose to input the quality of data needed for their purpose. We think coarse but low-cost data will be very important to help many industries and companies get started on natural and social capital, and build confidence to invest in better data if they need to.

NATURAL CAPITAL
Renewable & non-renewable natural resources

HUMAN CAPITAL
Knowledge, competencies & skills in an individual

SOCIAL CAPITAL
Networks & relationships with shared norms & values

INDICATORS: Nationally consistent

DATA SOURCES: Information grade. Repeatable, coarse, cheap — Investment grade. Repeatable, fine, not cheap

VALUATION METHODS: Nationally consistent

MEASURE & VALUE: Informed decisions — Precise decisions

SCOPE
WHAT?

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TARGET AUDIENCE

- Cotton growers and their advisers
- Cotton industry, particularly the Sustainability Working Group and researchers
- External stakeholders, particularly customers of Australian cotton lint and seed, and governments in Australia and overseas.

STAKEHOLDER ENGAGEMENT

Engagement will be via:

- Regular and ongoing meetings with senior cotton industry leaders and researchers who will form expert groups to inform measurement of capitals, and QDAF who will lead work to value capitals.
- Periodic Australian Agriculture Sustainability Framework working group briefings with other agriculture industry sustainability frameworks, natural and social capital input providers, governments and other interested stakeholders to share knowledge and use this work as a proof of concept for other industries
- Australian Cotton Sustainability Reference Group six-monthly meeting updates, and other engagement as needed with customers to ensure outputs are fit-for-purpose
- Government forums for cross-jurisdictional engagement and consistency.

SPECIFIC BENEFITS EXPECTED

- Industry benefit of more informed grower decision-making: increased productivity, resilience, and adoption of more sustainable practices
- Industry benefit of more informed stakeholder decision-making: increased trust, reduced risk
- Industry benefit of more informed industry decision-making: better allocation of resources where they are most needed
- Government benefit of internal capacity-building and applying knowledge gained across other industries.

OBJECTIVE

Quantify natural and human capitals to show how the cotton industry creates, preserves or erodes value over time to improve industry and external stakeholder decision-making to grow social licence and market access.

Workshop question: How will industry use this to grow social licence and market access?

- A: This assessment will help farmers decide if they need to change practices to manage natural and human resources, and industry decide if more or less needs to be invested in managing particular natural and human resources. Implicit in the entire project is data will be used to improve outcomes; to be explicit: better data needs to show the industry is performing better.

Workshop question: How does this relate to farmer decision-making / offset markets etc?

- A: The intent is, if this works, for farmers to apply ”investment grade” data to the same indicators and methods we use at industry scale, to inform their individual decision-making.

SCOPE
WHAT?

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BOUNDARY[1]

Direct operations: farms that grow cotton in Australia.

VALUE PERSPECTIVE

Primarily an industry perspective to reflect the objective of growing social licence and market access. Value to society will be considered where robust data is available and the value or cost is assessed as being material to the industry.

IMPACTS, DEPENDENCIES OR BOTH

Impacts on the cotton industry, and on the industry's dependencies.

TYPES OF VALUE

Quantitative or qualitative, with monetary (market valuation) wherever possible. Expecting extensive monetary valuations may be unrealistic at this stage of the project's maturity.

[1] A cotton farm is defined as a broadacre farms that includes cotton as one of its rotation crops.

[2] Capitals Coalition guidance for technical issues includes scenarios and recommends scenarios be used if the business application is to 'compare options'. This is not the intended application, so scenarios have not been used.

[3] The following topics were assessed as being of lower priority to cotton, but QDAF will monitor as they are likely to be material for other industries: Energy, GHG emissions, pesticide use and pollution; social capital/human rights.

TECHNICAL ISSUES[2]

- Baseline: 2020, unless otherwise stated.
- Temporal boundary: annual assessment where annual data is available; maximum of 5-yearly measurement for expensive or slow-changing indicators.

MATERIALITY: DETERMINE IMPACTS AND/OR DEPENDENCIES[3]

Impacts and dependencies were assessed against PLANET PEOPLE PADDOCK materiality criteria of stakeholder importance and industry impact. The materiality assessment was reviewed by government and industry stakeholders.

- Natural capital: Water availability and use. Soil quality and degradation. Land use change.
- Social capital: human capital (diversity and first nations inclusion, keeping farmers and permanent employees in the industry, and health & wellbeing of all people working on cotton farms).

Workshop question: What materiality method was used.

- A: AA1000 materiality approach (clear criteria for assessing effect on stakeholders and on the business – includes financial impact – and on sustainability topics).

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SPECIFY WHOSE VALUE PERSPECTIVE

A key action in your assessment is deciding whose value perspective to consider. You may focus your assessment on the value to business (i.e., business value) or on the value to society (i.e., societal value). An integrated capitals assessment implies a complete assessment should be undertaken and include both value perspectives, as they are integrally linked. However, there can be benefit in initially considering value perspectives separately so you can focus on how the results of the assessment can be communicated.

DECIDE ON ASSESSING IMPACTS AND/OR DEPENDENCIES

Your assessment may cover your impacts, your dependencies, or both. This will in part depend on the business application and your objective. A complete assessment considers both impacts and dependencies to gain a full understanding of your company's risk and opportunity related to natural, human, and social capitals.

It is important to note that impacts and dependencies are interrelated. They can be considered in the three Components of a complete capitals assessment:

- Impacts on your business (as a result of your impacts on natural, human and social capitals).
- Your impacts on society (as a result of your impacts on natural, human, and social capitals)
- Your business dependencies (benefits that your business receives from natural, human, and social capitals)

TYPES OF VALUE

The value of impacts and dependencies can be provided in three ways: qualitative, quantitative, and monetary.

- Qualitative valuation: Valuation that describes natural, human and social capitals impacts or dependencies and may rank them into categories such as high, medium, or low.
- Quantitative valuation: Valuation that uses non-monetary units such as numbers (e.g., in a composite index), area, mass, or volume to assess the magnitude of natural, social, and human capital impacts or dependencies.
- Monetary valuation: Valuation that uses money as the common unit to assess the values of natural, social and human capital impacts and/or dependencies.

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MATERIALITY

Whether or not a certain impact or dependency is material, and therefore important to include in your assessment, depends on its ability to alter your decision-making.

This materiality matrix can be used to help identify the most significant impact drivers and dependencies of different business activities, but you will need to complete a more comprehensive materiality assessment relevant to your business.

COTTON INDUSTRY MATERIALITY

An assessment of the materiality of cotton industry dependencies and impact drivers has been done in the Excel document attached to this. This work has identified as being most material:

NATURAL CAPITAL:

- Prioritising water availability and use and soil quality and degradation also links to other material impacts or dependencies: fertiliser use/pollution, pesticide use/pollution, GHG emissions (via N), C sequestration (via soil).
- Land use change / extent of woody vegetation is included because of its importance to stakeholders, and its links to soil and water: water regulation, pesticide use, C sequestration.

SOCIAL CAPITAL:

- The initial focus should be on HUMAN CAPITAL. Previous cotton industry research has been used to refine this to focus on the impact drivers of keeping farmers and permanent employees on farms, and of health and wellbeing.
- Consideration could also be given to measuring economic value generated, as a relatively simple way for all agriculture industries to provide evidence of this important driver of trust and acceptance.

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INDICATIVE MATERIALITY MATRIX FOR THE FOOD SECTOR VALUE CHAIN

DEPENDENCIES																VALUE CHAIN	IMPACT DRIVERS																				
NATURAL							HUMAN				SOCIAL				PR		NATURAL								HUMAN								SOCIAL			
WATER AVAILABILITY	WATER QUALITY	ENERGY	REGULATION OF PHYSICAL ENVIRONMENT	REGULATION OF BIOLOGICAL ENVIRONMENT	REGULATION OF WASTE AND EMISSIONS	SKILLS AND KNOWLEDGE	EXPERIENCE	WORKFORCE AVAILABILITY	HEALTH OF WORKERS	SOCIAL NETWORKS AND COOPERATION	PROPERTY RIGHTS	SOCIAL ACCEPTANCE AND TRUST	LAW AND ORDER	ACCESSIBILITY TO INFRASTRUCTURE & TECHNOLOGY			WATER USE	TERRESTRIAL ECOSYSTEM USE	GHG EMISSIONS	PESTICIDE, HERBICIDE AND FUNGICIDE USE	FERTILIZER USE	SOIL DEGRADATION	SOLID WASTE	LIVESTOCK CONDITIONS	NUTRITIONAL CONTENT OF FOOD	USE OF HARMFUL SUBSTANCES FOR CONSUMERS	FOOD SAFETY PRACTICES	EMPLOYEE HEALTH AND SAFETY CONDITIONS	SALARIES AND BENEFITS	WORKERS LIVING CONDITIONS	LABOUR RIGHTS	GENDER RIGHTS	WORKER'S REPRESENTATION	FOOD SECURITY	FOOD LOSS OR WASTE	INTEGRITY OF COMMUNITIES	BENEFIT SHARING WITH INDIGENOUS PEOPLE
M	H	H	H	H	H	H	H	H	H	M	H	M	M	H		INPUT MATERIALS	H	H	H	M	M	M	M	H	L	H	M	H	M	M	H	H	M	H	M	M	H
H	H	H	H	H	H	H	H	H	H	M	H	H	H	H		AGRICULTURE PRODUCTION	H	H	H	H	H	H	M	H	L	H	H	H	H	H	H	H	M	H	H	H	M
H	H	H	M	M	H	H	M	M	H	M	L	M	H	H		MANUFACTURING & PROCESSING	H	L	H	L	L	L	H	H	H	H	H	H	M	M	H	M	M	M	M	M	L
M	M	H	L	L	H	M	M	M	H	M	L	L	H	H		DISTRIBUTION & RETAIL	M	M	H	N	N	N	H	M	N	N	H	H	H	M	H	M	H	H	H	M	N
L	L	H	N	L	H	L	N	N	N	M	N	H	M	L		CONSUMPTION	L	L	M	N	N	N	H	M	H	H	H	N	N	N	L	L	L	H	H	L	N

MATERIALITY ACROSS WHOLE VALUE CHAIN

- H HIGH MATERIALITY
- M MEDIUM MATERIALITY
- L LOW MATERIALITY
- N NO MATERIAL

Based on FOLU (2019), OECD (2016), UNEP (2018), WBCSD (2018) and SASB (2018)

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SOIL QUALITY & DEGRADATION

DEPENDENCIES	IMPACT DRIVERS
Soil quality (FUNCTIONS): ▪ Water infiltration ▪ Water holding capacity ▪ Nutrient cycling ▪ Crop production	**Soil degradation / improvement** (PRACTICES) ▪ FOOD ▪ Living roots, biodiversity ▪ SHELTER ▪ Disturbance, cover

CHANGES FROM COTTON ACTIVITIES & IMPACTS	CHANGES FROM EXTERNAL FACTORS (natural or human-induced)	TREND: PRE-EUROPEAN TO BASELINE	TREND: DESIRED
▪ Area of arable land ▪ Soil properties TBC by Nat Soil Strat. Maybe: Soil C; Salinity; Acidity; Extractable P	▪ Minimal	Australian soils are degraded and face a number of challenges, including erosion, acidification, salinisation, sodification, soil carbon loss, contamination, and urban and industrial expansion[1].	Soil quality increasing as growers adopt more soil health practice

CONSEQUENCES – COST AND/OR BENEFIT (Consequences assessed as being most significant are bolded)	SIGNIFICANCE	VALUATION TECHNIQUE
▪ **Change in yield and input costs (bales/ha, $/ha, ML/ha water, kg/ha nutrients/pesticides)**	▪ **H**	TBC by Qld DAF at a later date.
▪ **Changes in C storage and GHG emissions (t/ha, t/bale, $/ha)**	▪ **H**	
▪ **Change in climate resilience**	▪ **H**	
▪ **Increase or decrease in community trust from perception of soil health practices (% trust)**	▪ **H (overall, maybe not soil specifically)**	
▪ **Per SEEA: Change in land value / soil resources ($/ha); change in biomass provisioning ($t or $/ha)**	▪ **H**	
▪ Changes in water quality through nutrient/fertiliser discharge (water quality measures)	▪ M	
▪ Loss of soil	▪ M	

[1] *State of the Environment 2021*

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WATER AVAILABILITY & QUALITY

DEPENDENCIES	IMPACT DRIVERS
Water availability ▪Water allocation ▪Crop production	**Freshwater use** ▪Volume of water withdrawn and consumed, total and by areas of water stress ▪Water use efficiency **Pollution** ▪Pesticide and nutrients discharged to water

CHANGES FROM COTTON ACTIVITIES & IMPACTS	CHANGES FROM EXTERNAL FACTORS (natural or human-induced)	TREND: PRE-EUROPEAN TO BASELINE	TREND: DESIRED
▪ Surface water flows / availability ▪ Groundwater levels / availability ▪ Potential impact on native fish habitat & length of riverbank buffers ▪ Potential impact from pesticide and nutrient runoff (mitigated by the closed-cycle nature of most irrigated cotton farms)	▪ Climate change has reduced inflows and water availability, and will create increasingly boom and bust cycles ▪ Regulatory changes manage water allocations within sustainable withdrawal limits ▪ Upstream impacts on water availability, quality and habitat	Climate change reducing water availability and increasing competition for (and scrutiny on) water use. Inland water quality is generally good in Australia[1].	Continued gains in water use efficiency enable cotton growers to adapt to changing climate conditions that will likely see allocations of sustainably withdrawn water reduced over time.

CONSEQUENCES – COST AND/OR BENEFIT (Consequences assessed as being most significant are bolded)	SIGNIFICANCE	VALUATION TECHNIQUE
▪ **Changing water allocations (from climate or regulation) affect crop viability and yield** ▪ **Changes in community and customer trust from perceived impact on water quantity and quality** ▪ **A need to adapt to increased variability / boom and bust cycles**	▪ **H** ▪ **H** ▪ **H**	TBC by Qld DAF at a later date.

[1] *State of the Environment 2021*

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LAND USE (NATIVE VEGETATION)

DEPENDENCIES	IMPACT DRIVERS
▪ Habitat – beneficial and threatened species ▪ Carbon sequestration	**Land use** ▪ Woody vegetation conversion or restoration ▪ Significant riparian patches conversion or restoration ▪ Species biomass / abundance / extinction threat ▪ Invasive alien species

CHANGES FROM COTTON ACTIVITIES & IMPACTS	CHANGES FROM EXTERNAL FACTORS (natural or human-induced)	TREND: PRE-EUROPEAN TO BASELINE	TREND: DESIRED
▪ Area of woody vegetation on farms ▪ Connectivity of significant riparian patches to regional high priority ecosystems	▪ Climate change/drought: kills planted and existing remnant vegetation; reduces income to invest in restoration ▪ Lack of cooperation and/or coordinated support with other industries / agencies hampers grower desire for restoration ▪ Biosecurity incursions kill vegetation	Overall, 13.2% of Australia's native vegetation has been replaced by urban, production and extractive uses of the land. Dryland and irrigated cropping and horticulture occurs on 4.9% of Australia's land[1]. Extent of native vegetation on cotton farms appears to have been largely static for several years.	Extent and condition of native vegetation in traditional cotton growing areas is maintained or enhanced.

CONSEQUENCES – COST AND/OR BENEFIT (Consequences assessed as being most significant are bolded)	SIGNIFICANCE	VALUATION TECHNIQUE
▪ **Change in pesticide use from change in beneficials habitat ($/ha)** ▪ **Changes in C stored on farms (t/ha, $/ha)** ▪ **Change in community trust from changes in habitat for threatened species (% trust)** ▪ **Changes in market access relating to changes in vegetation extent (description / value of markets)**	▪ **H** ▪ **H** ▪ **H** ▪ **H**	TBC by Qld DAF at a later date.

[1] *State of the Environment 2021*

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HUMAN CAPITAL

DEPENDENCIES	IMPACT DRIVERS
"Core" skilled employees: 1. Skills and knowledge 2. Experience 3. Motivations to innovate 4. Health and wellbeing 5. Diversity and Indigenous inclusion	1. Training, including professional development, on-farm skills training, extension activities 2. Income and/or wages; stress, burnout; management style (people-focused, not task-focused 3. Culture that encourages innovation; necessity; 4. Multiple factors drive health and wellbeing – this is the subject of ongoing research 5. Degree a workplace or industry is welcoming and inclusive

CHANGES FROM COTTON ACTIVITIES & IMPACTS	CHANGES FROM EXTERNAL FACTORS (natural or human-induced)	TREND: DESIRED
1. Skills and knowledge: On-farm skills development, precision agtech 2. Experience: Drivers of keeping core people: water reliability; investment in automation and tech; management style; community connectivity; culture 3. Motivations to innovate: Change in adoption of new practices that support sustainable intensification 4. Health & wellbeing: Investment in training changes risk and/or rate of injuries/fatalities 5. Diversity and Indigenous inclusion (including 'older'); pathway to career progression	▪ Experience: Migration to cities reduces skilled labour in some regions ▪ Health & wellbeing: Climate variability may increase stress, days working in extreme weather etc = increased stress and higher turnover	The combination of technological, climate and social changes make future farming workforce trends difficult to predict. The cotton industry has a culture and reputation that encourage a diversity of people to join the industry, develop their skills, innovate, and increase their satisfaction with the industry.

CONSEQUENCES – COST AND/OR BENEFIT	SIGNIFICANCE	VALUATION TECHNIQUE
1. Change Skills and knowledge: a) Productivity & profitability (t/ha, $/ha); change in gap between 'top 25' and 'bottom 25' farmers and impact on industry risk ($ value of industry reputation)	▪ M	TBC by Qld DAF at a later date.
2. Experience: Change in retention rate ($); change in local skills and collaboration (?) **a) Cost of replacing core employees** **b) Impact on farm business culture** **c) Loss of corporate knowledge / farm history** **d) Impact on productivity**	▪ **H**	
3. Motivations to innovate: Change in adoption of new practices that support sustainable intensification	▪ M	
4. Health & wellbeing: Change in serious injuries and fatalities ($, pressure on rural health services); food/energy poverty (people are more likely to be engaged in a community if feeling good about themselves)	▪ **H**	
5. Diversity and inclusion	▪ **H**	

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PRE-READING

While completing this Step keep in mind that

- Valuing natural, human, and social capitals can be helpful but is not the only basis for decision making, hence results should be presented as part of a suite of information, including details of the wider socioeconomic, legal, and business context.
- There will always be estimation or uncertainty of some kind involved in your valuation. It is important to identify where this occurs and clearly document the limitations of your assessment. Even rough approximations of value, when combined with a good understanding of the context, can provide relevant information for decision making.

TYPES OF VALUATION TECHNIQUES

For each cost and/or benefit identified, you will need to select an appropriate valuation technique based on whether you intend to assess values in qualitative, quantitative, or monetary terms.

- Qualitative valuation techniques are used to inform the potential scale of costs and/ or benefits expressed through qualitative, non-numerical terms (e.g., increase in air emissions, decrease in social benefits of recreation).
- Quantitative valuation techniques, in turn, focus on numerical data which are used as indicators for these costs and/or benefits (e.g., changes in tons of pollutants, decrease in number of people benefitting from recreation).
- Monetary valuation techniques translate quantitative estimates of costs and/or benefits into a single common currency.

All valuation methods have advantages and disadvantages and, generally speaking, a sequential, pragmatic approach from identifying and estimating costs and/or benefits qualitatively, followed by quantification and monetization, when possible, is recommended.

FOR THIS PROJECT, WHERE POSSIBLE WE WILL BE SEEKING TO APPLY MONETARY VALUATION TECHNIQUES.

Value measures and assumptions. The three simplest methods appear to be:

- Market and financial price (cost/price of services, opportunity cost etc) aka Exchange Values
- Production function (change in output volume or quality)
- Replacement costs (cost of replacing capitals with bought capitals, eg fertiliser)

Technique	Description	Data required	Indicative duration	Indicative budget	Skills required	Advantages	Disadvantages
Qualitative valuation							
Opinion surveys*	Surveys designed to represent views through a series of questions, (e.g., semi-structured interviews)	Stakeholder information to inform sampling frame	Weeks - Months	$$	Questionnaire design, interviewing	– Open ended so can capture broad information	– Does not allow much quantification – Results may be subject to bias from respondents
Deliberative approaches	Facilitated group discussions or focus groups that can involve debate and learning such as brainstorming sessions/workshops/focus groups/in-depth discussions	Stakeholder information to inform sampling frame	Weeks - months	$$	Questionnaire design, facilitation	– Open ended so can capture broad information	– Does not allow much quantification – Difficult to obtain representative sample of attendees – Results may be subject to bias from respondents and sample selection, and can be hypothetical in nature
Relative valuation	Use of high/medium/low values to determine relative value of benefits (and/or costs) in categorical terms, using available data and expert judgment	Information on all parameters to be valued	Days - weeks	$	Analytical	– Can be very broad and include any parameters desired	– Can be subjective – Results may be subject to bias from respondents
Quantitative valuation							
Structured surveys*	Structured surveys or questionnaires can be used to elicit quantitative values: One-to-one surveys employing a consistent set of questions including "closed" response options (e.g., Y/N, scoring, numerical choices) that allow for statistical analysis	Stakeholder information to determine sampling frame	Weeks - months	$$	Questionnaire design, interviewing, statistics	– Enables greater level of quantification	– Allows less opportunity to capture broader information – Results may be subject to bias from respondents
Indicators*	Various indicators can be used to quantify information, such as air emissions, yield of produce per hectare, the risk of species extinction, or visitor numbers	Information on all parameters to be valued— ideally quantified information	Weeks	$$	Analytical, statistics	– Can be very broad and include any parameters desired	– May not capture all the relevant values
Multi-criteria analysis (MCA) using scoring and weighting**	Involves selecting a range of parameters and rating and ranking their value through scoring and weighting, using workshops, available data, and/or expert judgment. It is the scoring and weighting that is effectively the 'valuation' technique.	Information on all parameters to be valued— ideally quantified information	Weeks - months	$$	Analytical, statistics	– Can be very broad and include any parameters desired – Can be kept simple	– Sensitive to ratings and rankings chosen – Can become overly complicated
Monetary valuation							
Market and financial prices***	This includes several related approaches, including: – Costs/prices paid for goods and services traded in markets (e.g. timber, carbon, value of water bill or pollution permit) – Other internal/financial information (e.g., estimated financial value of liabilities, assets, receivables) – Other interpretations of market data (e.g., derived demand functions, opportunity costs, mitigation costs/aversive behavior, cost of illness)	Market prices of ecosystem goods and/or services Costs involved to process and bring the product to market (e.g., crops)	Days - weeks	$	Economics—or econometrician	– A transparent and defensible method since based on market data – Reflects actual willingness to pay (WTP)	– Only applicable where a market exists for the good or service and price data are readily available – Market prices may be distorted by imperfect competition and/or policy failures, hence not a good measure of societal value
Production function (change in production)	Empirical modelling approach that relates change in the output of a marketed good or service to a measurable change in natural capital inputs (e.g., the quality or quantity of ecosystem services)	Data on changes in output of a product Data on cause and effect relationship (e.g., crop losses due to reduced water availability)	Days - weeks	$	Economics, (potentially agronomist, hydrologist and/or process engineer, etc)	– If all required data are available, the technique can be implemented fairly easily – Can link natural capital dependencies to financial accounts	– Necessary to recognize and understand the relationship between a change in natural capital, ecosystem services and/or abiotic services, and output of product – Can be difficult to obtain data on relevant changes in natural capital, the ecosystem service and effect on production

	Technique	Description	Data required	Indicative duration	Indicative budget	Skills required	Advantages	Disadvantages (Including applicability to components)
Cost-based approaches	Replacement costs	The cost of replacing natural capital with an artificial substitute (product, infrastructure, or technology). May be estimated, observed, or modeled	The cost (at market prices**) of replacing natural capital (or associated ecosystem goods or services) with man-made equivalents (e.g., replacing flow regulation of habitat with flood defense scheme)	Days - weeks	$	Basic economics, engineering	– Provides surrogate measures of value for regulatory services (which are difficult to value by other means) – A readily transparent method when based on market data	– Does not consider social preferences for services or behavior in the absence of the services – The replacement service probably only represents a proportion of the full range of services provided by the natural resource
	Damage costs avoided	The potential costs of property, infrastructure, and production losses due to natural capital degradation, treated as a "saving" or benefit from conserving natural capital. May be estimated, observed, or modeled	Data on costs incurred to property, infrastructure, or production as a result of decline in natural capital or the loss of associated ecosystem services Damages under different scenarios	Weeks	$$	Engineering and bio-physical processes	– Provides surrogate measures of value for regulatory services that are difficult to value by other means (e.g., storm, flood, and erosion control)	– The approach is largely limited to services related to properties, assets, and economic activities – Can overestimate values
Revealed preference (indirect)	Hedonic pricing	Based on the observation that environmental factors are one of the determinants of the market price of certain goods (e.g., the environmental quality of a neighborhood affects the prices of properties located there). This technique models variations in market prices, controlling for other variables to isolate the environmental factor of interest. The extent to which price varies with this factor reveals its value	Data relating to differences in property prices or wages that can be ascribed to the different natural capital qualities (e.g., status of river, area of green space, distance from forest)	Days - months	$$$	Econometrics	– Readily transparent and defensible method since based on market data and WTP – Property and wage markets are generally very responsive so are good indicators of value	– Approach is largely limited to costs and benefits related to property or wages – The property and wage market is affected by a number of factors in addition to environmental attributes, so these need to be identified and controlled for (e.g., number of bedrooms, training required)
	Travel costs	Based on the observation that environmental and marketed goods and services are often complements (i.e., you need to spend money and valuable time on travel to visit a place where you can enjoy natural features). Measures travel and other costs incurred when visiting a natural asset for recreation or leisure, to elicit a value per visit. Assumes such spending is a minimum expression of the value of individuals' experience (otherwise people would not take the trouble)	The amount of time and money people spend visiting a site for recreation or leisure purposes Motivations for travel	Weeks - months	$$$	Questionnaire design, interviewing, econometrics	– Based on actual behavior (what people do) rather than a hypothetically stated WTP – Results are relatively easy to interpret and explain	– Approach is limited to use of recreational benefits – Difficulties in apportioning costs when trips are to multiple places or are for more than one purpose
Stated preference	Contingent valuation (CV)	Infers ecosystem values by asking individuals their maximum willingness to pay (or willingness to accept compensation) for a specified change in the relevant non-market good or service from natural capital	Socio-economic and demographic information on survey respondents	Weeks - months	$$$	Questionnaire design, interviewing, econometrics	– Captures both use and non-use values – Extremely flexible— can be used to estimate the economic value of virtually anything	– The results are hypothetical in nature and subject to numerous different biases from respondents
	Choice experiments (CE)	Individuals are presented with alternative goods/ options with different characteristics (i.e., various attributes or levels, such as distance, number of species present, or some other aspect of natural capital), as well as different prices. They are asked to choose their preferred option, from which the value for the relevant non-market good or service from natural capital may be inferred	As for CV above An appropriate set of "levels" are required for key parameters (e.g., poor, medium, good, and excellent river water quality)	Weeks - months	$$$	Questionnaire design, interviewing, econometrics	– Captures both use and non-use values – Good for providing breakdown of estimated marginal changes (e.g. values per % increase in coral cover)	– Results are subject to bias from respondents and are hypothetical in nature – Choices given to respondents must be limited to what they can understand and weigh up during the duration of the survey
Value Transfer								
Value (benefits) transfer****		Values an impact driver in one context based on valuation evidence (identified using one or more of the above techniques) determined in another context. Specific adjustments should be made to account for differences between the two contexts	Valuations based on above techniques applied to similar studies elsewhere; A very common starting place for most companies Data on key variables from different studies (e.g., GDP per person)	Days - weeks	$	Knowledge of above technique(s) used in existing studies, and econometric analysis if using functions	– Low cost and rapid method for estimating values	– Although simple to use, it needs to be applied carefully – Results are likely to be subject to a higher level of uncertainty compared to (well-conducted) primary research. The extent to which this can be accepted is dependent on the decision-context – Existing valuation studies will be more robust and numerous for some services / impacts than for others

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