International Water Management Institute

german cooperation DEUTSCHE ZUSAMMENARBEIT

Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

TRAINING MANUAL FOR Mahatma Gandhi National Rural Employment Guarantee Scheme (NREGS)– IMPACT REPORTING TOOL (MiRA)

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1. Introduction

The MGNREGA (Mahatma Gandhi National Rural Employment Guarantee Act) was a law passed in 2005 under which the Central government proposed to implement a nation-wide social security scheme to guarantee the "right to work", targeting individuals residing in rural regions. The programme was officially introduced in February 2006, in 200 districts in its first phase. This was further expanded in the second phase in 2007, with another 30 districts added to the total and concluded with the final phase in 2008 during which the remaining districts were covered. The Act stands as one of the India's largest employment programs for over a decade. The program's core objective is to enhance livelihood security in rural areas. It guarantees at least 100 days of wage employment per year to every household. While wage employment remains a key focus, MGNREGA also envisions the creation of assets that strengthen natural resource management. These assets aim to address crucial issues like drought, deforestation, and soil erosion, promoting sustainable development in the long run.

Extensive research has been conducted to assess MGNREGA effectiveness as a safety net program, analysing its impact on wage, income, and consumption. However, a gap exists in understanding the nature of the created assets and their lasting impact on people's lives. MGNREGA is often primarily viewed as a job creation program, neglecting its potential for significant asset creation (Reddy, 2016). To address this issue, IWMI along with GIZ developed a web application which aims to evaluate the potential impact generated through the assets created under MGNREGA. This is part of Indo-German bilateral project 'Water Security and Climate Adaptation in Rural India (WASCA)'. The objective of the project is to work towards enhancing water resources management with regards to water security and climate adaptation in rural areas through an integrated approach at national, state, and local level. The project is commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) in partnership with the Ministry of Rural Development (MoRD) and Ministry of Jal Shakti (MoJS) in India and implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

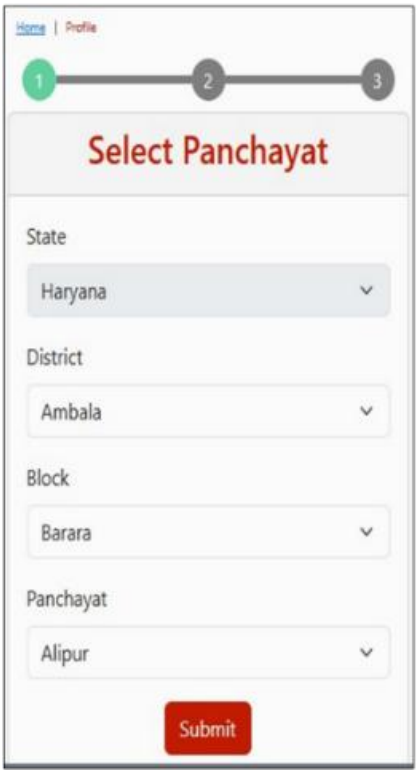
2. MGNREGA impact Reporting Application (MiRA)

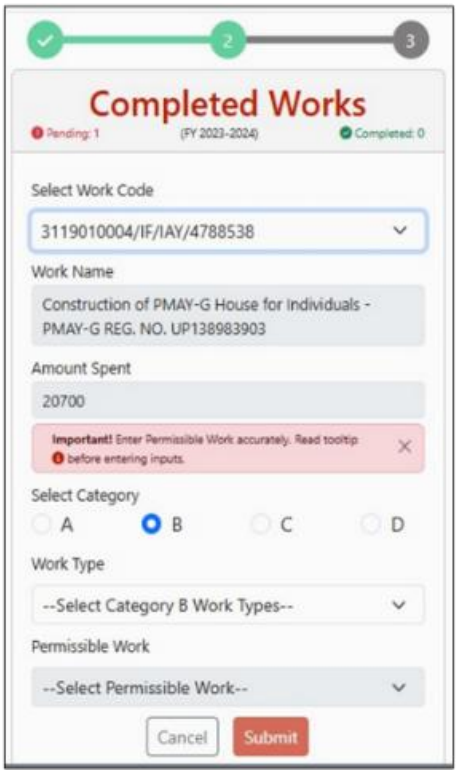
MiRA is an interactive online web application which captures the potential outcomes of MGNREGA works. The tool is designed as a value addition to the existing MIS (Management Information System) portal and will determine the potential impact of MGNREGA works and provide data for comparison of the performance of a work/asset over time and across different villages, blocks, and districts. The tool considers data collection feasibility, the purpose of each asset type (construction, repair, or renovation), and the specific work involved. Designed for immediate completion after project finalization, the application gathers qualitative and quantitative indicators to provide a holistic picture of the asset's estimated impact.

3. MGNREGA impact Reporting Application (MiRA) work flow

The application follows a structured four-step process to capture and measure asset-related data:

1. Register and sign in (user can register for one district)
2. After signing in, select geographical area – select state -> district -> block -> panchayat.
3. Select work from the list of completed works within the panchayat that is updated in the system
4. For the selected work, select work code/ name / category / types (Linked with NREGS MIS) – Selected relevant work details such as work code, work type, category, permissible work – which is linked existing Management Information System (MIS) for integration.
5. Enter Relevant Input Parameters - Provide work type specific input values and submit.
6. Measure Output Indicators - Calculate and track the output indicators based on the provided inputs.





4. Work Category wise Input Indicators

All 266 activities are listed in the application with input indicators defined. Below section gives the description of the input indicators. These works are divided into broader categories (e.g., Non-NRM, check dams, plantations, etc) which have similar indicator.

4.1 Category: Non-NRM Activities

1. Construction of PMAY-G House Building for Individuals	
Work Type	Construction of PMAY-G or State Scheme House Building for Individuals
Input Indicator 1	Number of Beneficiary households

***Number of beneficiary households**: This indicates the number of households that benefitted for the PMAY-G scheme.*

2. Community Sanitary Complex	
Work Type	**Construction of Community Sanitary Complex**
Input Indicator 1	Number of Beneficiary households

***Number of beneficiary households**: This indicates the number of households benefitted from the construction of Community Sanitary Complex*

3. Anganwadi	
Work Type	**Construction of Anganwadi Building for Community**
Input Indicator 1	Number of Beneficiary households
Input Indicator 2	Number of people/children

***Number of beneficiary households**: This indicates the estimated number of families who will have improved access to childcare and early childhood education services due to the construction of the Anganwadi building.*
***Number of children/women**: This represents the estimated number of children who will benefit from early childhood education programs and the number of women who will have access to maternal health services offered at the Anganwadi.*

4. Schools	
Work Type	**Construction of Compound Wall for Government Schools for Community**
Input Indicator 1	Number of students

Number of students: *The number of students who will study in the school.*

5. *Foodgrain Storage*	
Work Type	**Repair and Maintenance of Food grain Storage Building for Community**
Input Indicator 1	Number of Beneficiary households

Number of beneficiary households: *The number of households benefitted from using the food grain storage.*

6. *Roads*	
Work Type	Construction of Bitumen Top / Mitti Muram / WBM / Cement Concrete Roads for Community
Input Indicator 1	Number of Beneficiary households

Number of beneficiary households: *The number of households benefitted from the construction.*

7. Shelters for Livestock	
Work Type	**Construction / Repair and maintenance of shelter for Individuals / Community (Cattle shelter, goat shelter, Piggery shelter, poultry, livestock shelter)**
Input Indicator 1	Number of Beneficiary households
Input Indicator 2	Number of livestock benefitted

Number of beneficiary households*: This indicates the estimated number of families whose livestock will have access to the shelter.*
For individual work type, number of beneficiary is 1. For community work, number of beneficiaries should be less than 500.
Number of livestock benefitted: *Number of livestock benefitted by the constructed shelter.*

8. *Playground*	
Work Type	**Construction of Playfield for Community**
Input Indicator 1	Number of Beneficiary Households

Number of Beneficiary households: *The number of households whose kids usually play in the constructed field.*

4.2 Natural Resource Management (NRM) activities

4.2.1 Bunds

1. Bunds (Construction / Repair and Maintenance)	
Work Type	**Construction, Repair and maintenance of peripheral / field / contour / graded bund (Earthen / Pebble / Stone) for community/individuals**
Input Indicator 1	Additional Area (in hectares) expected to be treated for soil and water conservation and improved crop cultivation
Input Indicator 2	Number of Beneficiary households

Additional Area (in hectares) expected to be treated for soil and water conservation and improved crop cultivation: *Expected area to be treated for in-situ moisture conservation or risk of erosion for enhanced crop cultivation via bunding practices. Unit of measurement for this indicator is hectare.*
Number of Beneficiary households: *The number of households that could potentially benefit from construction of bunds. Beneficiary households are those whose land has been improved.*

Example image of Bunds constructed

1. Bund is covering and improving moisture retention (reducing runoff, erosion) in 2 ha of land, hence “Additional Area (in hectares) expected to be treated for soil and water conservation and improved crop cultivation” is 2 ha.
2. Number of households owning the 2 ha are the beneficiaries, hence “Number of beneficiary households” is 2.

4.2.2 Land

2. Land Development (Silvipasture grasslands)	
Work Type	**Development of Silvipasture Grasslands for Community/individuals**
Input Indicator 1	Area (in hectares) developed as Silvipasture grasslands
Input Indicator 2	Number of livestock benefitted
Input Indicator 3	Number of beneficiary households

Area (in hectares) developed as Silvipasture Grasslands: *Total land area that has been converted into grasslands with agroforestry (intercropping of trees). Unit of measurement for this indicator is in hectares (ha).*
Number of livestock benefitted: *Total number of livestock's using the developed silvipasture grasslands for grazing.*
Number of Beneficiary households: *Households that benefitted will include households that owns the livestock, and using the products from the silvipasutre grasslands.*

3. Land Development (Chaur land, water logged land)	
Work Type	**Development of Chaur land, water logged land.**
Input Indicator 1	Area (in hectares) made suitable for productive use (grazing / plantation / horticulture, etc).
Input Indicator 2	Number of beneficiary households

Area (in hectares) made suitable for productive use (grazing / plantation / horticulture, etc): *Total land area made suitable for productive use for one or more purpose such as grazing / plantation / horticulture, etc. Unit of measurement for this indicator is in hectares (ha).*
Number of Beneficiary households: *Households that benefitted from development of chaur land / waterlogged land.*

4. Land Development (Development of fallow / waterlogged / waste land)

Work Type	**Levelling / shaping and reclamation of waterlogged land, levelling /shaping of wasteland.**
Input Indicator 1	Area estimated to be protected/reclaimed for productive use from waterlogging/waste land (ha)
Input Indicator 2	Number of beneficiary households

Area estimated to be protected/reclaimed for productive use from water logging/waste land (ha): *Total land area made suitable for productive use for one or more purpose by levelling, shaping and reclamation of waterlogged areas / fallow / waste land. Unit of measurement for this indicator is in hectares (ha).*
Number of Beneficiary households: *Households that benefitted form by levelling, shaping and reclamation of waterlogged areas / fallow / waste land.*

	duals / Community / Groups
Input Indicator 1	Irrigation potential created (ha)
Input Indicator 2	Number of beneficiary households

Irrigation potential created (ha): *Area that is covered under irrigation due to construction of open well. Unit of measurement for this indicator is in hectares (ha).*
Number of Beneficiary households: *The number of households that could potentially benefit from construction of irrigation open well.*

2. Wells (parapet & platform)	
Work Type	**Repair and maintenance of parapet & platform for irrigation open well for community**
Input Indicator 1	Number of beneficiary households

Number of Beneficiary households: *The number of households that could potentially benefit from repair and maintenance of parapet and platform.*

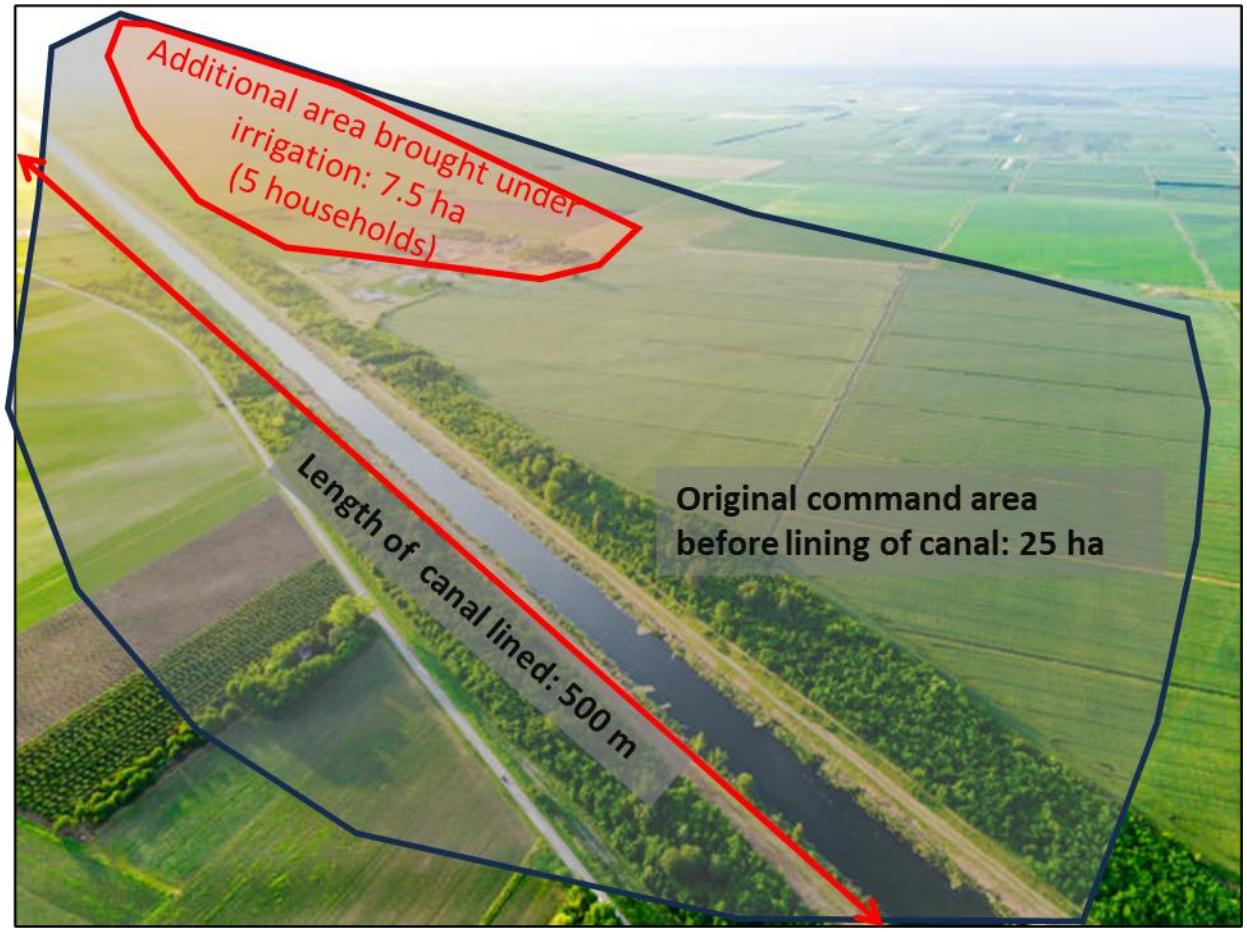
4.2.4 Canal

1. Canal (construction)	
Work Type	**Construction of feeder / distributary / minor / sub-minor canal / Water courses**
Input Indicator 1	Irrigation potential created (ha)
Input Indicator 2	Number of Beneficiary households

Irrigation potential created (ha): *Total area brought under irrigation due to construction of canal/water courses. Unit of measurement for this indicator is in hectares (ha).*
Number of Beneficiary households: *The number of households that could potentially benefit from construction of canal/water courses.*

2. Canal (Lining of canals)	
Work Type	**Lining of feeder / distributary / minor / sub-minor canal / water courses**
Input Indicator 1	Number of days water is available in canal
Input Indicator 2	Additional Irrigation potential created (ha)
Input Indicator 3	Length of lined canal (m)
Input Indicator 4	Width of lined canal (m)
Input Indicator 5	Depth of lined canal (m)
Input Indicator 6	Command area served by the canal (ha)
Input Indicator 7	Number of Beneficiary households

Length of lined canal: *The length of the canal that will be lined. Unit of measurement for this indicator is in meter (m).*
Width of lined canal: *The width of the canal that will be lined. Unit of measurement for this indicator is in meter (m).*
Depth of lined canal: *The depth of the canal that will be lined. Unit of measurement for this indicator is in meter (m).*
Number of days water is available in canal: *The number of days in a year water is expected to be available in the canal in a year.*
Command area served by the canal (ha): *The original command area served by the canal according to the administrative records. Unit of measurement for this indicator is in hectare (ha).*
Additional Irrigation potential created (ha)*: Additional area brought under irrigation due to lining of canal. This area is within the command area but was not served before. Unit of measurement for this indicator is in hectare (ha).*
Number of Beneficiary households: *Households that gained access to water for irrigation due to canal lining.*



1. In this example image, a 500 m stretch of existing unlined canal has been lined. The canal width is 2m and depth is 1.5m, hence “Length of canal lined” is 500m, width of lined canal is 2m and depth of lined canal is 1.5m.
2. “Command area served by the canal (ha)” is the original designed command area irrigated by the canal as per administrative records. In this example, designed command area of the canal (ha)” is 25 ha.
3. In this example, additional area brought under irrigation (ha) is 7.5 ha (Red boundary) due to lining of canal. This area is within the command area but was not served before.
4. “Number of beneficiary households”: is the households that own the additional irrigated area (for example: 5 households own 7.5 ha) due to lining of canal. Hence, “Number of Beneficiary households” is 5.

3. Canal (Renovation, repair and maintenance)	
Work Type	**Renovation Repair and maintenance of feeder / distributary / minor / sub-minor canal**
Input Indicator 1	Length of canal repaired (m)
Input Indicator 2	Additional area brought under irrigation (Yes/No)
Input Indicator 3	Additional Irrigated area (in hectares) created
Input Indicator 4	Command area served by repaired/renovated/maintenance of canal

Command area served by the canal (ha): *The original command area served by the canal according to the administrative records. Unit of measurement for this indicator is in hectare (ha).*
Additional Irrigation potential created (ha)*: Additional area brought under irrigation due to renovation/ repair and maintenance of canal. This area is within the command area but was not served before. Unit of measurement for this indicator is in hectare (ha).*
Number of Beneficiary households: *Households that gained access to water for irrigation due to renovation/repair and maintenance.*

4.2.5 Drainage

1. Drainage (Construction/repair/renovation of flood/diversion channel)	
Work Type	**Construction of Flood/Diversion Channel for Community**
Input Indicator 1	Area protected from flooding / erosion (ha)
Input Indicator 2	Number of Beneficiary households

Area protected from flooding / erosion (ha): *The area where the risk of flooding or erosion is significantly reduced or eliminated due to the construction of a flood/diversion channel. Unit of measurement for this indicator is in hectares (ha).*
Number of Beneficiary households: *Households that benefit from reduced flood risk due to the construction of the flood/diversion channel.*

4.2.6 Drainage / erosion

1. Construction / repair of storm water / grey water drain)	
Work Type	**Construction of storm water drain**
Input Indicator 1	Area protected from flooding / erosion (ha)
Input Indicator 2	Number of Beneficiary households

Area protected from flooding / erosion: *The expected area where the risk of flooding and erosion is reduced or eliminated. Unit of measurement for this indicator is in hectares (ha).*
Number of Beneficiary households: *Households that benefit from reduced flood risk due to the construction/ repair and maintenance.*

2. Construction of Level bench terrace, Upland bench terrace	
Work Type	**Construction of level / upland bench terrace**
Input Indicator 1	Area to be treated for cultivation/horticulture (ha)
Input Indicator 2	Number of Beneficiary households

Area (in hectares) to be treated for cultivation/horticulture: Total area treated and reclaimed for cultivation/horticulture and other productive use. *Unit of measurement for this indicator is in hectares (ha).*
Number of Beneficiary households: *The number of households that could potentially benefit from using the constructed bench terrace.*

In this example image, 4 ha of bench terrace is constructed, and 3 households are benefitting from that. “Area to be treated for cultivation/horticulture (ha):” 4 ha, and “Number of beneficiary households”: 3

3. Construction of contour trenches	
Work Type	**Construction of continuous contour trench for individual/community**
Input Indicator 1	Infiltration Rate
Input Indicator 2	Average Length of contour trench (m)
Input Indicator 3	With of trench (m)
Input Indicator 4	Depth of trench (m)
Input Indicator 5	Number of days water available/retained in a year
Input Indicator 6	Number of contour lines
Input Indicator 7	Additional Area (in hectares) expected to be treated for soil and water conservation and improved crop cultivation

Infiltration Rate: *Indicates the rate at which water is entering into the soil per hour (i.e. depth of the water layer (in mm) that can enter in the soil in an hour). Unit of measurement is millimetres/hour (mm/hour). Unit of measurement is millimetres/hour (mm/hour). Infiltration rate ranges between 1 and 30. Choose infiltration rate based on soil type.*

Infiltration rates for various soil types:

Sand:<30 mm/hr

Sandy loam: 20 to 30 mm/hr

Loam: 10 to 20 mm/hr

Clay loam:5 to 10 mm/hr

Clay: 1 to 5 mm/hr.

Number of contour lines: *Number of contour lines on which contour trench has been constructed. Number of contour lines ranges from 1 to 100.*

Average length of contour trench*: The average length of a contour trench along a single contour line, measured from one end to the other. Average length ranges from 1 to 200 meters. Unit of measurement is in meters (m).*

Depth of trench*: The vertical distance between ground level to the bottom of the trench. Unit of measurement is in meters (m).*

Width of trench*: The width of the trench along each contour line. Unit of measurement is in meters (m).*

Number of days water retained in a year: *The number of days that trench is expected to retain water in a year.*

Area (in hectares) expected to be protected\reclaimed from soil erosion and with improved moisture regime: *The expected area where the risk of erosion is significantly reduced or eliminated, and soil moisture storage is improved after the construction of continuous contour trenches. Unit of measurement for this indicator is in hectares (ha).*

4. Construction of staggered trenches

Work Type	Construction of staggered trench for individual/community
Input Indicator 1	Infiltration Rate
Input Indicator 2	Average length of staggered trench (m)
Input Indicator 3	With of trench (m)
Input Indicator 4	Depth of trench (m)
Input Indicator 5	Number of days water retained in a year
Input Indicator 6	Area (in hectares) expected to be protected\reclaimed from soil erosion and with improved moisture regime
Input Indicator 7	Number of trenches

Infiltration Rate: *Indicates the rate at which water is entering into the soil per hour (i.e. depth of the water layer (in mm) that can enter in the soil in an hour). Unit of measurement is millimetres/hour (mm/hour). Infiltration rate ranges between 1 and 30. Choose infiltration rate based on soil type.*
Infiltration rates for various soil types:
Sand:<30 mm/hr
Sandy loam: 20 to 30 mm/hr
Loam: 10 to 20 mm/hr
Clay loam:5 to 10 mm/hr
Clay: 1 to 5 mm/hr.
Average length of staggered trench*: Average length of a single staggered trench. Unit of measurement is in meters (m*
Depth of trench*: The vertical distance between ground level to the bottom of the trench. Unit of measurement is in meters (m).*
Width of trench*: The width of the trench. Unit of measurement is in meters (m).*
Number of staggered trenches: *Number of trenches.*
Number of days water retained in a year: *The number of days that trench is expected to retain water in a year.*
Area (in hectares) expected to be protected\reclaimed from soil erosion and with improved moisture regime: *The expected area where the risk of erosion is significantly reduced or eliminated, and soil moisture storage is improved after the construction of staggered trenches. Unit of measurement for this indicator is in hectares (ha)*

4.2.7 Check dams / gully plugs (erosion)

1. Construction / Repair and maintenance of Check dams	
Work Type	**Construction / repair and maintenance of Brushwood / Boulder / Gabion Check Dam and gully plugs for individuals / community**
Input Indicator 1	Width of stream
Input Indicator 2	Height of check dam
Input Indicator 3	Length of water spread area
Input Indicator 4	Area (in hectares) protected from flooding/erosion
Input Indicator 5	Number of wet spells

***Width of stream**: Horizontal distance between the two banks of the stream at the check dam location. It provides an indication of how wide the stream is (horizontal distance between two banks). Unit of measurement is in meters.*

***Height of check dam:** The height at which check dam is being built. The vertical distance from the base of the check dam (i.e. from streams bed level) to its highest point (i.e. top of check dam's body wall). Unit of measurement is in meters (m).*

***Length of water spread area:** This measures how far the water extends on the upstream side of the check dam. It indicates the distance from the check dam to the furthest point where the water spreads out. Unit of measurement is in meters.*

***Area (in ha) protected from flooding/erosion:** The extent of land that benefits from reduced flood risk and soil erosion, contributing to improved land stability due to the presence of the check dam. Unit of measurement is hectares*

***Number of wet spells:** Count of distinct periods of significant rainfall events in a year. To be considered a distinct rainfall event - Each wet spell represents a continuous duration of rainfall sufficient to produce runoff that reaches the check dam.*

For example, if you are analyzing the precipitation pattern over a month:

- ***Example**:*
  - *Days 1-3: Precipitation occurs each day.*
  - *Days 4-7: No precipitation.*
  - *Days 8-10: Precipitation occurs each day.*
  - *Days 11-15: No precipitation.*
  - *Days 16-18: Precipitation occurs each day.*

*In this case, you would have **three** wet spells:*

1. *Days 1-3*
2. *Days 8-10*
3. *Days 16-18*

Example image of boulder check dam

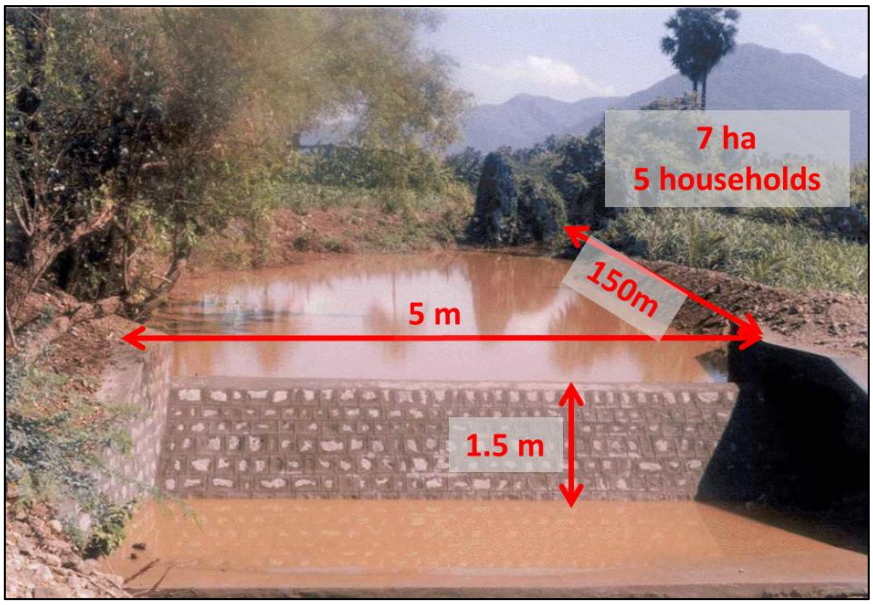
1. In this example image (boulder check dam), Width of the stream is 3m wide, and same length as the check dam. Hence, *"Width of stream" is 3 m.*
2. Top level of check dam is 1m from the bottom of the check dam (i.e. stream bed level), hence, *"Height of the check dam" is 1 m.*
3. "Length of water spread area: In this example, Length of the water spreads/stored upto 100m from the check dam location. Hence, *"Length of water spread area" is 100 m.*
4. Check dam protects 7 ha of catchment area on either sides of the stream banks from erosion and flooding. Hence, "*Area (in ha) protected from flooding/erosion" is 7 ha.*
5. Same approach applies to gabion and brushwood check dam/gully plugs.

4.2.8 Check dams (storage)

6. Construction / Repair and Maintenance of check dam	
Work Type	**Construction of Earthen / Masonry / Cement concrete Check Dam for individuals / community**
Input Indicator 1	Width of Stream (m)
Input Indicator 2	Height of Check Dam (m)
Input Indicator 3	Length of water spread area (m)
Input Indicator 4	Number of days water available / retained in a year
Input Indicator 5	Irrigation potential created (ha)
Input Indicator 6	Number of Beneficiary households

Width of stream*: Horizontal distance between the two banks of the stream at the check dam location. It provides an indication of how wide the stream is from one side to the other, helping to understand the stream's width. Unit of measurement is in meters (m).*
Height of check dam*: The height at which check dam is being built. The vertical distance*

Example image of masonry check dam



1. In this example image (masonry check dam), average width of the stream is 5m wide. Hence, *"Width of stream" is 5 m.*
2. Top level of check dam is 1.5m from the bottom of the check dam (i.e. stream bed level), hence, *"Height of the check dam" is 1.5 m.*
3. Length of the water spreads/stored upto 150m from the check dam location. Hence, *"Length of water spread area" is 150 m.*
4. Total number of days in a year during which there is at least minimum amount of water store in the check dam. For example, if visible amount of water is available in the check dam for 70 days, then *"Number of days water available in a year"* is 70 days.

5. Water stored in the check dam provides irrigation to 7 ha of arable land. Hence, *"Irrigation potential created" is 7 ha.*
6. In this example, 5 households own the 7 ha of land that is receiving irrigation from check dam. Hence, *"Number of beneficiary households"* is 5
7. Same approach applies to earthen and cement concrete (CC) check dam.

4.2.9 Storage

1. Roof top Rainwater harvesting	
Work Type	**Roof top rainwater harvesting structures in govt./panchayat building**
Input Indicator 1	Surface area of the roof top
Input Indicator 2	Average annual rainfall (mm)

Surface area of the roof top from which rainwater is collected: *Surface area of roof top from which rainwater is collected and recharged. Unit of measurement is meter square (m^2). Surface area of roof top ranges from 50 to 20000 sq.m.*
Average annual rainfall (mm): *Amount of rainfall the region receives during a year. Unit of measurement is milli meters (mm).*

2. Farm Ponds	
Work Type	**Construction of farm ponds**
Input Indicator 1	Length of farm pond (m)
Input Indicator 2	Width of farm pond (m)
Input Indicator 3	Depth of farm pond (m)
Input Indicator 4	Irrigation potential created (ha)
Input Indicator 5	Number of beneficiary households

Length of farm pond (m): *The length of the pond. Unit of measurement is meter (m).*
Width of farm pond (m): *This refers to the width of the pond if it is rectangular. Unit of measurement is meter (m).*
Depth of farm pond (m): *This refers to the depth of the pond or average depth. Depth of pond ranges from 0.1 to 5 meters Unit of measurement is meter (m).*
Irrigation Potential Created (ha): *Maximum area that is expected to receive irrigation from the pond. It indicates the extent of agricultural land that can be irrigated using the water stored from the pond. Unit of measurement is in hectare (ha)*
Number of beneficiary households: *This refers to the number of households that benefit from construction of farm pond.*

4.2.10 Recharge

1. *Mini Percolation Tank*	
Work Type	**Construction / Repair and maintenance of Mini Percolation Tank for individuals/community**
Input Indicator 1	Length of tank (m)
Input Indicator 2	Width of Tank (m)
Input Indicator 3	Depth of Tank (m)
Input Indicator 4	Infiltration rate (mm/hr)
Input Indicator 5	Average number of days water available/retained in a year

Length of Tank: *Measurement of the tank from one end to the other at the longer side. Unit of measurement is in meters.*
Width of Tank: *Measurement of the tank from side to side, typically perpendicular to the length. Unit of measurement is in meters.*
Depth of Tank*: Measurement of depth of tank is typically measured from the top surface to the bottom. Unit of Measurement is in meters.*
Infiltration rate: *It measures the speed at which water is entering into the soil. It is measured by the depth of the water layer that can enter in the soil in an hour. Unit of measurement is millimetres/hour (mm/hour). Infiltration rate values ranges between 1 and 30. Choose infiltration rate based on soil type.*
Infiltration rates for various soil types:
Sand: <30 mm/hr
Sandy loam: 20 to 30 mm/hr
Loam: 10 to 20 mm/hr
Clay loam: 5 to 10 mm/hr
Clay: 1 to 5 mm/hr
Number of days water is available / retained in a year: *The number of days water is available in a year.*

2. *Recharge Pits*	
Work Type	**Construction of Recharge Pits for Individual/Community**
Input Indicator 1	Length of Pit (m)
Input Indicator 2	Width of Pit (m)
Input Indicator 3	Depth of Pit (m)
Input Indicator 4	Infiltration rate (mm/hr)
Input Indicator 5	Number of rainy days in a year

Length of Pit: *The length of pit refers to the distance from one end of the pit to the other end. Unit of measurement is in meters (m).*
Width of Pit: *The width would determine the capacity of the filter and amount of water it can process. Unit of measurement is in meters (m).*
Depth Pit*: The vertical distance from the top opening of the pit to the bottom of the pit. Unit of measurement is in meters (m).*
Infiltration Rate: *It measures the speed at which water is entering into the soil. It is measured by the depth of the water layer that can enter in the soil in an hour. Unit of measurement is millimetres/hour (mm/hour). Infiltration rate values ranges between 1 and 30. Choose infiltration rate based on soil type.*
Infiltration rates for various soil types:
Sand: <30 mm/hr
Sandy loam: 20 to 30 mm/hr
Loam: 10 to 20 mm/hr
Clay loam: 5 to 10 mm/hr
Clay: 1 to 5 mm/hr
Number of rainy days in a year: *The average number of rainy days per year.*

4.2.11 Storage / recharge

3. Community Water Harvesting Ponds (Renovation/Repair/Construction)	
Work Type	**Renovation of Community Water Harvesting Ponds for Community**
Input Indicator 1	Length of community pond (m)
Input Indicator 2	Width of community pond (m)
Input Indicator 3	Depth of community pond (m)
Input Indicator 4	Number of days water is available / retained in a year
Input Indicator 5	Irrigation potential created (ha)
Input Indicator 6	Number of beneficiary households

Length of community pond (m): *The length of the pond. Unit of measurement is meter (m).*
Width of community pond (m): *This refers to the width of the pond. Unit of measurement is meter (m).*
Depth of community pond (m): *This refers to the depth of the pond.*
Number of days water is available / retained in a year: *The number of days that harvesting pond is expected to retain water in a year.*
Irrigation Potential Created (ha): *Maximum area that is expected to receive irrigation from the pond. It indicates the extent of agricultural land that can be irrigated using the water stored from the pond. Unit of measurement is in hectare (ha)*
Number of beneficiary households: *This refers to the number of households that benefit from*

4.2.12 Grey Water

1. Grey water (Soak pits / Soakage channel / stabilization pond)	
Work Type	**Construction of Soakage channel / Soak pits / Stabilization pond**
Input Indicator 1	Number of beneficiary households

Number of beneficiary households: Number of households connected to the soak pits / soakage channel / stabilization ponds are the beneficiaries.

4.2.13 Compost / nutrients

1. Compost / Nutrients (Compost pit / Vermicompost / NADEP / Berkeley compost)	
Work Type	**Construction / repair and maintenance of compost pit / vermicompost structure / NADEP structure / Berkeley compost / Bio-manure pits**
Input Indicator 1	Length of pit (m)
Input Indicator 2	Width of pit (m)
Input Indicator 3	Depth of pit (m)
Input Indicator 4	Number of beneficiary households

Length of pit (m): Length of the pit / structure in which the compost is prepared. *Unit of measurement is meters (m).*
Width of pit (m): Width of the pit / structure in which the compost is prepared. *Unit of measurement is meters (m).*
Depth of pit (m): Depth of the pit / structure in which the compost is prepared. *Unit of measurement is meters (m).*
Number of beneficiary households: Number of households using the compost for improving the soil health and fertility of their land.

2. Compost / Nutrients (Azolla pit)	
Work Type	**Construction / repair and maintenance of infrastructure for Azolla cultivation**
Input Indicator 1	Length of pit (m)

Input Indicator 2	Width of pit (m)
Input Indicator 3	Depth of pit (m)
Input Indicator 4	Number of livestock benefitted
Input Indicator 5	Number of beneficiary households

Length of pit (m): Length of the pit / structure in which the compost is prepared. *Unit of measurement is meters (m).*
Width of pit (m): Width of the pit / structure in which the compost is prepared. *Unit of measurement is meters (m).*
Depth of pit (m): Depth of the pit / structure in which the compost is prepared. *Unit of measurement is meters (m).*
Number of livestock households: Number of livestock benefitted by consuming the azolla prepared from the pits.
Number of beneficiary households: Number of households owning the livestock are the beneficiary households.

4.2.14 Nursery

1. Nursery	
Work Type	**Raising of nursery for Individuals / groups / communities**
Input Indicator 1	Number of saplings raised

Number of saplings raised: Total number of saplings raised in nursery for planting in the region

4.2.15 Tree Plantation

1. Tree plantation (line plantation)	
Work Type	**Line plantation (boundary / coastal / wasteland / canal / road side) line plantation of trees (horticulture / farm forestry / forestry / shelter belt trees)**
Input Indicator 1	Number of plants
Input Indicator 2	Total length of plantation (m)
Input Indicator 3	Type of plant / trees (Option to select multiple tree species in the give tree list)
Input Indicator 4	1. Number of plants/trees (tree species 1) 2. Number of plants/trees (tree species 2) 3. . 4. .

	5. . 6. n (n = number of tree species selected in “Input Indicator 3”)

Number of plants: Total number of plants/trees planted per asset id
Total length of plantation (m): Total length of the road line / coastal line / boundary line / wasteland line / canal line on which all the trees are planted. *Unit of measurement is meters (m).*
Type of plant / trees: The user is given list of 160 species. User selects all the species planted.
Number of plants / trees: For the tree species selected, user need to enter how many plant/trees planted for each species type.

2. Tree plantation (Block plantation)	
Work Type	**Block plantation (wasteland / coastal area) of trees (horticulture / farm forestry / forestry / shelter belt trees / bio-drainage trees / sericulture trees))**
Input Indicator 1	Number of plants
Input Indicator 2	Total area of plantation (ha)
Input Indicator 3	Type of plant / trees (Option to select multiple tree species in the give tree list)
Input Indicator 4	1. Number of plants/trees (tree species 1) 2. Number of plants/trees (tree species 2) 3. . 4. . 5. n (n = number of tree species selected in “Input Indicator 3”)

Number of plants: Total number of plants/trees planted per asset id
Total area of plantation (ha): Total area of the block area (in hectares) on which all the trees are planted. *Unit of measurement is hectares (ha). Total area of plantation ranges from 0.1 to 100 ha.*
Type of plant / trees: The user is given list of 160 species. User selects all the species planted.
Number of plants / trees: For the tree species selected, user need to enter how many plant/trees planted for each species type.

4.2.16 Fishery

1. Fishery	
Work Type	**Construction / Repair and maintenance of Fisheries pond / Fish drying yards for individual / community**
Input Indicator 1	Number of beneficiary households

Number of beneficiary households: Number of households benefitting from the fishery ponds and fishery drying yards.

5. Expected outcomes

To assess the expected outcomes of Mahatam Gandhi NREGS activity, each permissible NREGA activity is assigned specific input indicators as given above. In total, 266 activities are associated with 64 unique input indicators. These input indicators are linked to 18 expected outcomes, which are broadly classified into 6 categories (Water Management, Irrigation, Area improvement, Plantation, Compost and beneficiaries) (Table 1).

There are two types of expected outcomes: direct and estimated. For direct outcomes, the input indicators directly provide the required information. For example, expected irrigation potential created by a water structure or number of households benefitted. For estimated outcomes, it is challenging to obtain direct input data, such as for groundwater recharge or carbon sequestration. In these cases, a web tool calculates expected outcomes using predefined formulas. These formulas include calculations for groundwater recharge based on the GEC (Groundwater Estimation Committee) guidelines or tree species specific formulas for carbon sequestration. For further details, please refer to the formula's given in the next section.

Output	Category	Type
Land Reclaimed / Developed	Area Improved	Direct
Area Protected from Flooding / Erosion	Area Improved	Direct
Irrigation Potential Created	Irrigation	Direct
Irrigation Command Area Improved	Irrigation	Direct
Number of Households	Number of Beneficiaries	Direct
Number of Children	Number of Beneficiaries	Direct
Number of Livestock	Number of Beneficiaries	Direct
Number of Students	Number of Beneficiaries	Direct
Total Area of Plantation	Plantation	Direct
Number of Plants	Plantation	Direct
Length of Plantation	Plantation	Direct
Carbon Sequestered	Plantation	Estimated
Volume of Silt Trapped	Soil Health	Estimated
Volume of Compost	Soil Health	Estimated
Groundwater Recharged	Water Management	Estimated
Volume of Water Storage Created	Water Management	Estimated
Volume of Grey Water Managed	Water Management	Estimated
Reduction in Water Losses	Water Management	Estimated

5.1 Formulas for estimating outcomes

5.1.1 Volume of Water Storage Created (m^3)

- **Activity: Check Dam (Earthen / CC/ Masonry Check-Dam)**

The volume of water stored in the check-dam is calculated using FAO's inverted pyramid formula:

$$Storage\ (m^3) = (L * W * H)/4$$

Inputs

L – Length of water spread area on the upstream side of the check dam). (m).
W – Width of stream (m)
H – Height of check dam (m)
4 is the correction factor. The formula for estimating storage capacity assumes that the water stored behind a check dam forms an inverted pyramid (wider at the top, narrower at the bottom).
Since the actual shape of water storage is not a perfect pyramid, a correction factor (4, 5, or 6) is used to adjust for real-world conditions.

- Factor 4 - Used when the valley is wide and shallow, meaning more water can be stored.
- Factor 5 or 6 - Used when the valley is narrow and deep, meaning less water is stored than estimated.

https://www.fao.org/4/i1531e/i1531e.pdf

- **Activity: Community Water Harvesting Ponds**

$$Storage\ (m^3) = Length * Width * (\frac{depth}{2}) \qquad Eq.1$$

Inputs

$Length$ – Length of community pond (m)
$Width$ – Width of community pond (m)
$Depth$ – Depth of community pond (m)

- **Activity: Farm Ponds**

$$Storage\ (m^3) = Length * Width * Depth \qquad Eq.2$$

Inputs

$Length$ – Length of the pond (m)
$Width$ – Width of the pond (m)
$Depth$ – Depth of the pond (m)

- **Activity: Roof Top Rainwater Harvesting**

$$Volume\ of\ rainwater\ harvested\ (m^3) = area * rainfall * 0.001$$

Input

area – Surface area of roof top (m^2)
rainfall – Average annual rainfall (mm)
Volume represents the potential contribution to the storage capacity created

5.1.2 Groundwater Recharged (m^3)

- **Activity: Check dam (Earthen / CC/ Masonry check dam)**

$$Recharge\ (m^3) = L * W * H * N_{(f)} * 0.5 \qquad Eq.5$$

Inputs

L – Length of water spread area on the upstream side of the check dam). (m).
W – Width of stream (m)
H – Height of check dam (m)
$N_{(f)}$ - Number of refilling's in a year
0.5 represents that 50% of the gross storage is available for recharge (GEC, 2015, Page 33)

- **Activity: Check dam (Brushwood / Gabion / Boulder check dam) / Gully Plugs (Earthen / stone boulder)**

$$Recharge\ (m^3) = L * W * H * N_{(s)} * 0.5 \qquad Eq.5$$

Inputs

L – Length of water spread area on the upstream side of the check dam). (m).
W – Width of stream (m)
H – Height of check dam (m)
$N_{(s)}$- Number of wet spells in a year
0.5 represents that 50% of the gross storage is available for recharge (GEC, 2015, Page 33)

- **Activity: Recharge Pits**

$$Recharge\ (m^3) = L * W * \left[\left(\frac{i}{1000}\right) * 24\right] * N_{(r)} * 0.5 \qquad Eq.5$$

Inputs

L – Length of pit (m).
W – Width of pit (m)
$N_{(r)}$ - Number of rainy days in a year
i – Infiltration rate (mm/hr)

0.5 represents recharge efficiency, meaning only 50% of the available recharge potential is realized due to biophysical limitations such as biofouling, sedimentation, and soil permeability limitations.

- **Activity: Community Water Harvesting Ponds**

$$Recharge\ (m^3) = Length * Width * days * 0.6 * \left(\frac{1.4}{1000}\right) \quad \textit{Eq.3}$$

Inputs

$Length$ – Length of community pond (m)
$Width$ – Width of community pond (m)
$days$ – Number of days water available/retained in a year
1.4 – is the infiltration rate (mm/day)
0.6 – 60% of the maximum water spread area is used as average area of the water spread (GEC 2015, Page 33).

- **Activity: Mini Percolation Tank for Individuals / Community**

$$Recharge\ (m^3) = L * W * D * N_{(s)} * 0.5 \quad \textit{Eq.5}$$

Inputs

L – Length of tank. (m).
W – Width of tank (m)
D – Depth of tank (m)
$N_{(s)}$- Number of wet spells in a year
0.5 represents that 50% of the gross storage is available for recharge (GEC 2015, Page 33).

- **Activity: Staggered trench / Water absorption trench**

$$Recharge\ (m^3) = L * W * days * 0.5 * \left[\left(\frac{i}{1000}\right) * 24\right] * N_{(t)}$$

Inputs
L – Average length of trench (m)
W – Width of trench (m)
$days$ – Number of days water is available/retained in a year
i – Infiltration rate (i) in mm/hour
$N_{(t)}$ – number of trenches
0.5 represents recharge efficiency, meaning only 50% of the available recharge potential is realized due to biophysical limitations such as biofouling, sedimentation, and soil permeability limitations.

- **Activity: Contour trench**

$$Recharge\ (m^3) = L * W * days * 0.5 * \left[\left(\frac{i}{1000}\right) * 24\right] * N_{(c)}$$

Inputs

L – Length of trench (m)
W – Width of trench (m)
$days$ – Number of days water is available/retained in a year
i – Infiltration rate (i) in mm/hour
$N_{(c)}$ – number of contour lines
0.5 represents recharge efficiency, meaning only 50% of the available recharge potential is realized due to biophysical limitations such as biofouling, sedimentation, and soil permeability limitations.

5.1.3 Volume Of Silt Trapped (m^3)

- **Activity: Check dam (Earthen / CC/ Masonry check-dam / Brushwood / Gabion / Boulder) , Gully Plugs (Earthen / Stone boulder)**

$$Volume\ of\ silt\ (m^3) = (L * W * H)/4 \qquad Eq.5$$

Inputs

L – Length of water spread area on the upstream side of the check dam). (m).
W – Width of stream (m)
H – Height of check dam (m)
4 is the correction factor. The same formula used to estimate storage capacity can also be used to estimate silt deposition in a check dam.
Since silt settles in a similar pattern as stored water—wider at the top and narrowing towards the bottom - the inverted pyramid assumption still applies.

- Factor 4 - Used when the valley is wide and shallow, meaning more silt can accumulate.
- Factor 5 or 6 - Used when the valley is narrow and deep, meaning silt deposition is more compact.

https://www.fao.org/4/i1531e/i1531e.pdf

- **Activity: Staggered trench**

$$Volume\ of\ Silt\ Trapped\ (m^3) = L * W * D * N_{(t)}$$

Inputs
L – Average length of trench (m)
W – Width of trench (m)
D – Depth of Trench (m)
$N_{(t)}$ – Number of trenches

- **Activity: Contour Trench**

$$Volume\ of\ Silt\ Trapped\ (m^3) = L * W * D * N_{(c)}$$

Inputs

L – Average length of trench (m)

W – Width of trench (m)

D – Depth of Trench (m)

$N_{(c)}$ – Number of contour lines

5.1.4 Volume Of Grey Water Managed (m^3)

- **Activity: Soak Pit for Individuals / Community**

$$Recharge\ (m^3) = N * 4 * 60 * 365 * 0.001 \qquad Eq.5$$

Inputs

N – Number of households connected to the soak pit.

4 – Average number of persons per household.

60 – It is assumed that the requirement of water for domestic use is 60 liters per day per person.

365 is the number of days in a year.

5.1.5 Reduction in water loss (m^3)

- **Activity: Lining of canals**

$$Reduction\ in\ water\ loss\ (m^3) = (L * (2D + W) * 0.175 * days) - (L * (2D + W) * 0.045 * days)$$

Inputs

0.175 – Seepage factor for unlined canal

0.045 – Seepage factor for lined canal

$days$ – Number of days water is available in a year

L – Length of canal lined

D – Depth of canal lined

W – Width of canal lined

Norms recommended for canal seepage factor were sourced from (GEC,2015 ; Table-9, Page 78.

5.1.6 Volume of Compost (m^3)

Activity: Compost pits

$$Volume\ of\ compost\ (m^3) = L * W * D * 0.35 * 3$$

Inputs

L - Length of the pit (m)

W - Width of the pit (m)

D - Depth of the pit (m)
0.35 – is the compost conversion rate (i.e. proportion of raw material that turns into compost after decomposition).
3 – represents the number of times compost pit are refilled in a year.

5.1.7 Carbon sequestered (MT)

Carbon sequestration is calculated for each tree species (Table 3) using the volumetric and biomass equations (Table 2)

$$Carbon\ Sequestered\ (MT) = \sum N_{(i)} * C_{(i)}$$

Inputs

$N_{(i)}$ - Number of trees for specific tree species

$C_{(i)}$ - Carbon sequestered (MT) by single tree of specific tree species (inbuilt in tool - **Table 3**)

Table 2: Formula for calculating carbon from trees.

ICFRE (2020). Resource Manual: Measurement of Forest Carbon Stocks for Capacity Building of State Forest Departments. Indian Council of Forestry Research and Education, Dehradun (INDIA).

BE1: Biomass equations to estimate biomass of small wood tress having DBH 10cm or more.
BE2: Biomass equations to estimate biomass of foliage of tree having DBH 10 cm or more.
BE3: Biomass equations to estimate biomass of small wood tress having DBH less than 10 cm.
BE4: Biomass equations to estimate biomass of foliage of tree having DBH less than 10 cm.
DBH or D: Diameter at breast height in meter. D_1: diameter at breast height in cm.

Tree	Scientific Name	Volumetric equation (m^3)	BE1 or BE3 (in kg)	BE or BE4 (in kg)
Aam	Mangifera indica	V=(0.108-1.706D+7.559DD)	$BE_1=133.7182D^2+199.3136D-9.3631$	$BE_2=10.8365D^2+2.7031D+1.2266$
Fir	Abies spp.	V=0.293884-3.441808D+15.922114D^{2}	$BE3=-0.0491D_1^2+2.7026D_1-2.8253$	$BE4=-0.0022D_1^3+0.0260D_1^2+0.1971D_1-0.0809$
Khair	Acacia catechu	V=0.02384-0.72161D+7.46888D^{2}	$BE_1=412.4293D^2-101.8017D+21.9977$	$BE_2=5.0812D^2+1.7792D+0.3749$
		V/D^{2}=0.16609/D^{2}-2.78851/D+17.22127-11.60248D	$BE_1=-40.0134D^2+178.4533D-4.2859$	$BE_2=10.8820D+0.0076$
		V=-0.02471+0.16897D+1.12083D^{2}+2.9328D^{3}	$BE_1=-40.0134D^2+178.4533D-4.2860$	$BE_2=10.8820D+0.0077$
		V=0.04235-0.74240D+7.26875D^{2}	$BE_1=862.9319D^2-170.7552D+21.2422$	$BE_2=32.5724D^2-6.4454D+0.8018$
		V=-0.048108+5.873169D^{2}	$BE_1=461.0594D^2+127.4788D-8.6248$	$BE_2=14.1668D^2+8.6870D-0.4187$
Babul	Acacia nilotica	$\sqrt{V}$=-0.00142+2.61911D-0.54703$\sqrt{D}$	$BE_1=-67.6663D^2+113.1102D+4.3385$	$BE_2=-8.2494D^2+12.7608D-0.7229$
Acacia	Acacia spp.	$\sqrt{V}$=-0.00142+2.61911D-0.54703$\sqrt{D}$	$BE_1=-67.6663D^2+113.1102D+4.3385$	$BE_2=-8.2494D^2+12.7608D-0.7229$
Maple	Acer spp.	$\sqrt{V}$=-0.10851+3.04250D	$BE1=-46.9981D^2+148.5105D+1.1836$	$BE2=-1.0538D^2+4.4842D+0.0036$
Ailanthus	Ailanthus altissima	V=0.15958-1.57976D+8.25014D^{2}-0.48518D^{3}	$BE_1=133.7182D^2+199.3136D-9.3631$	$BE_2=10.8365D^2+2.7031D+1.2266$
		V=0.081467-1.063661D+6.452918D^{2}	$BE_1=133.7182D^2+199.3136D-9.3632$	$BE_2=10.8365D^2+2.7031D+1.2267$

		V/D=0.088074/D-1.449236+8.760534D	BE_1=133.7182D^2+199.3136D-9.3633	BE_2=10.8365D^2+2.7031D+1.2268
		V/D=0.088074/D-1.449236+8.760534D	BE_1=133.7182D^2+199.3136D-9.3634	BE_2=10.8365D^2+2.7031D+1.2269
Siris	Albizia lebbeck	√V=-0.07109+2.99732D-0.26953√D	BE1=-46.9981D^2+148.5105D+1.1852	BE2=-1.0538D^2+4.4842D+0.0052
Utis	Alnus nepalensis	V/D^{2}=0.06674/D^{2}-0.02039/D+0.001559(dia D is in cm)	BE_1=-458.2088D^2+893.8913D-66.9783	BE_2=-10.0112D^2+18.4510D-1.0379
Cashew	Anacardium occidentale	V=(0.108-1.706D+7.559DD)	BE_1=133.7182D^2+199.3136D-9.3631	BE_2=10.8365D^2+2.7031D+1.2266
Dhauri	Anogeissus latifolia	√V=-0.20236+3.13059D	BE_1=-185.9612D^2+363.4651D-23.7470	BE_2=-8.7736D^2+18.6843D-1.2968
		V=-0.061856+7.952136D^{2}	BE_1=-185.9612D^2+363.4651D-23.7471	BE_2=-8.7736D^2+18.6843D-1.2969
		V/D^{2}=-0.02958/D^{2}+8.05003	BE_1=-185.9612D^2+363.4651D-23.7472	BE_2=-8.7736D^2+18.6843D-1.2970
		V=0.289-2.653D+11.771D^{2}	BE_1=-185.9612D^2+363.4651D-23.7473	BE_2=-8.7736D^2+18.6843D-1.2971
		V=0.030502-1.105937D+12.261268D^{2}	BE_1=-222.4935D^2+246.0476D-15.0305	BE_2=-3.3058D^2+14.4901D-1.1089
		V=0.13928-2.87067D+20.22404D^{2}-13.80572D^{3}	BE_1=-222.4935D^2+246.0476D-15.0306	BE_2=-3.3058D^2+14.4901D-1.1090
		V=0.289-2.653D+11.771D^{2}	BE_1=674.1855D^2-110.5556D+29.0427	BE_2=33.2586D^3-19.0005D^2+8.5843D+0.1584
		V=0.289-2.653D+11.771D^{2}	BE_1=674.1855D^2-110.5556D+29.0428	BE_2=33.2586D^3-19.0005D^2+8.5843D+0.1585
Angu	Artocarpus hirsutus	V=0.076-1.319D+11.370D^{2}	BE_1=-185.9612D^2+363.4651D-23.7470	BE_2=-8.7736D^2+18.6843D-1.2968
Neem	Azadirachta indica	V=-0.03510+5.32981*D*D	BE_1=164.0576D^2+98.0941D+1.3802	BE_2=7,4373D^2+3.4612D-0.0140
Bans	Bambusa bambos			
Bamboo	Bambusa spp.			
Kwiral	Bauhinia variegate	V=0.10970-0.88666D+6.09700D^{2}-1.62672D^{3}	BE_1=412.4293D^2-101.8017D+21.9977	BE_2=5.0812D^2+1.7792D+0.3749
Semul	Bombax ceiba	V/D^{2}=0.18573/D^{2}-2.85418/D+15.03576	BE_1=142.4990D^2+15.7340D+11.7480	BE_2=4.1172D^2+0.8835D+0.2329

		V/D^{2}=0.136196/D^{2}-2.07674/D+10.1566	BE_1 = 142.4990 D^2 + 15.7340 D + 11.7480	BE_2=4.1172 D^2 +0.8835 D + 0.2329
Deodar	Cedrus deodara	V=0.10970-0.88666D+6.09700D^{2}-1.62672D^{3}	BE_1=412.4293D^2-101.8017D+21.9977	BE_2=5.0812D^2+1.7792D+0.3749
Kapok	Ceiba pentandra	V=0.10970-0.88666D+6.09700D^{2}-1.62672D^{3}	BE_1=412.4293D^2-101.8017D+21.9978	BE_2=5.0812D^2+1.7792D+0.3750
Ringal	Chimnobabusa falcata	V=0.10970-0.88666D+6.09700D^{2}-1.62672D^{3}	BE_1=412.4293D^2-101.8017D+21.9977	BE_2=5.0812D^2+1.7792D+0.3749
Tejpatand	Cinnamomum tamala	V=0.10970-0.88666D+6.09700D^{2}-1.62672D^{3}	BE_1=412.4293D^2-101.8017D+21.9977	BE_2=5.0812D^2+1.7792D+0.3749
Nimbu	Citrus limon	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1839	BE2=-1.0538D^2+4.4842D+0.0039
Malta	Citrus X sinensis	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1834	BE2=-1.0538D^2+4.4842D+0.0034
Surai	Cupressus torulosa	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1855	BE2=-1.0538D^2+4.4842D+0.0055
Shisham	Dalbergia sissoo	V/D^{2}=0.00331/D^{2}+0.000636 (D (dia) is in cm)	BE_1=7.2757D^2+53.1018D+12.3640	BE_2=-4.6845D^2+14.7263D-0.0240
Cheura	Diploknema butyracea	V=0.02894-0.89284D+8.72416D^{2}	BE_1=33.6773D^2+101.4271D-2.2653	BE_2=16.6353D^2+18.3505D-1.1172
Other	Equation for rest of species	V=0.15958-1.57976D+8.25014D^{2}-0.48518D^{3}	BE_1=-185.9612D^2+363.4651D-23.7470	BE_2=-8.7736D^2+18.6843D-1.2968
		V=0.081467-1.063661D+6.452918D^{2}	BE_1=-185.9612D^2+363.4651D-23.7471	BE_2=-8.7736D^2+18.6843D-1.2969
		V/D=0.088074/D-1.449236+8.760534D	BE_1=-185.9612D^2+363.4651D-23.7472	BE_2=-8.7736D^2+18.6843D-1.2970
		V/D=0.088074/D-1.449236+8.760534D	BE_1=-185.9612D^2+363.4651D-23.7473	BE_2=-8.7736D^2+18.6843D-1.2971
Eucalyptus	Eucalyptus spp.	V=0.02894-0.89284D+8.72416D^{2}	BE_1=33.6773D^2+101.4271D-2.2653	BE_2=16.6353D^2+18.3505D-1.1172
Timla	Ficus auriculata	√V=0.03629+3.95389D-0.84421√D	BE_1=328.6517D^2+41.5013D+5.8245	BE_2=43.8976D^2+1.7589D+0.3012
Kokum	Garcinia indica	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1831	BE2=-1.0538D^2+4.4842D+0.0031
Bhimal	Gmelina arborea	V=0.01156+0.21230D+5.10448D^{2}	BE1=-46.9981D^2+148.5105D+1.1852	BE2=-1.0538D^2+4.4842D+0.0052
Phalyat	Grewia asiatica	V=0.018620+13.916741D^{3}	BE1=431.9626D^2+42.0418D+5.3807	BE2=23.9226D^2-1.6761D+0.4293
Kharsu	Grewia optiva	V=0.018620+13.916741D^{3}	BE1=431.9626D^2+42.0418D+5.3807	BE2=23.9226D^2-1.6761D+0.4293
Haldu	Haldina cordifolia			

Jatropha	Jatropha curcas	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1824	BE2=-1.0538D^2+4.4842D+0.0024
Akhrot	Juglans regia	V=0.15958-1.57976D+8.25014D^{2}-0.48518D^{3}	BE_1=133.7182D^2+199.3136D-9.3631	BE_2=10.8365D^2+2.7031D+1.2266
Subabul	Leucaena leucocephala	√V = -0.00142 + 2.61911 D -0.54703 √D	BE_1=192.6516D^2-41.3427D+12.0217	BE_2=6.2026D^2-1.2040D+0.3180
Mahua	Madhuca longifolia	V=0.063632+5.355486D^{3}	BE_1=-185.9612D^2+363.4651D-23.7470	BE_2=-8.7736D^2+18.6843D-1.2968
		V=-0.00092-0.55547D+7.34460D^{2}	BE_1=-185.9612D^2+363.4651D-23.7470	BE_2=-8.7736D^2+18.6843D-1.2968
Karanja	Millettia pinnata	V/D=0.077965/D-1.481043+9.797028D	BE_1=328.6517D^2+41.5013D+5.8245	BE_2=43.8976D^2+1.7589D+0.3012
Bakil	Mimusops elengi	V=0.15958-1.57976D+8.25014D^{2}-0.48518D^{3}	BE_1=133.7182D^2+199.3136D-9.3631	BE_2=10.8365D^2+2.7031D+1.2266
Shahtoot	Morus spp.	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1849	BE2=-1.0538D^2+4.4842D+0.0049
Kafal	Myrica esculenta	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1825	BE2=-1.0538D^2+4.4842D+0.0025
Olive	Olea europaea	V=-0.03001+5.75523D^{2}	BE1=-46.9981D^2+148.5105D+1.1852	BE2=-1.0538D^2+4.4842D+0.0052
Kharik	Phoenix dactylifera	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1829	BE2=-1.0538D^2+4.4842D+0.0029
Anwala	Phyllanthus emblica	V=-0.022635+4.889163D^{2}	BE_1=133.7182D^2+199.3136D-9.3631	BE_2=10.8365D^2+2.7031D+1.2266
Spruce	Picea spp.	√V=0.20050+4.58840D-1.42603√D	BE_1=328.6517D^2+41.5013D+5.8245	BE_2=43.8976D^2+1.7589D+0.3012
Chir	Pinus roxburghii	√V=0.05131+3.9859D-1.0245√D	BE_1=608.6848D^2-82.2998D+19.9426	BE_2=26.2180D^2+1.6287D+0.8936
Chamkharik	Pithecellobium dulce			
Poplar	Populus spp.	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1842	BE2=-1.0538D^2+4.4842D+0.0042
Wild Aprikot	Prunus armeniaca	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1862	BE2=-1.0538D^2+4.4842D+0.0062
Amrood	Psidium guajava	V/D=0.088074/D-1.449236+8.760534D	BE_1=133.7182D^2+199.3136D-9.3632	BE_2=10.8365D^2+2.7031D+1.2267
Mehal	Pyrus pashia	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1835	BE2=-1.0538D^2+4.4842D+0.0035
Moru	Quercus floribunda	V/D^{2}=0.0988/D^{2}-1.5547/D+10.1631	BE_1=69.2347D^2+135.6707D-1.4147	BE_2=0.8100D^2+8.7234D+0.1811
Banj	Quercus leucotrichophora	V/D^{2}=5.09470+0.00563/D^{2}	BE_1=69.2347D^2+135.6707D-1.4147	BE_2=0.8100D^2+8.7234D+0.1811
Robinia	Robinia pseudoacacia	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1844	BE2=-1.0538D^2+4.4842D+0.0044
Salix	Salix alba	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1847	BE2=-1.0538D^2+4.4842D+0.0047
Sal	Shorea robusta	V/D^{2}=0.1919/D^{2}-2.7070/D+11.7563	BE_1=-56.4459D_2+140.2030D+6.1908	BE_2=-3.4159D_2+18.1330D+0.2431
		√V=0.16306+4.8991D-1.57402“D	BE_1=-56.4459D_2+140.2030D+6.1908	BE_2=-3.4159D_2+18.1330D+0.2431

		V/D2=0.00389/D^{2}-0.27516/D+6.90733	BE_1=239.3148D^2-3.3963D+21.0528	BE_2=21.7716D^2+3.7241D+0.5622
		V=0.05823-1.22994D+10.51982D^{2}	BE_1=25.5451D^2+201.6606D-13.1829	BE_2=9.1786D^2+11.0520D-0.8946
		√V=0.19994+4.57179D-1.56823√D	BE_1=-136.4916D^2+321.3854D-15.6215	BE_2=20.7480D^2+0.9479D+0.4223
		√V=0.19994+4.57179D-1.56823√D	BE_1=-136.4916D^2+321.3854D-15.6216	BE_2=20.7480D^2+0.9479D+0.4224
Simarouba	Simarouba glauca	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1851	BE2=-1.0538D^2+4.4842D+0.0051
Jajoba	Simmondsia chinensis	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1822	BE2=-1.0538D^2+4.4842D+0.0022
Jamun	Syzygium cumini	√V=-0.05923+2.33654D	BE_1=133.7182D^2+199.3136D-9.3632	BE_2=10.8365D^2+2.7031D+1.2267
		V=0.08481-1.81774D+12.63047D^{2}-6.69555D^{3}	BE_1=133.7182D^2+199.3136D-9.3633	BE_2=10.8365D^2+2.7031D+1.2268
		V=0.2736-3.377D+12.959D^{2}	BE_1=148.1069D^2+306.2417D-20.7654	BE_2=-4.0782D^2+8.9461D+0.0084
		√V=0.30706+5.12731D-2.09870√D	BE_1=148.1069D^2+306.2417D-20.7655	BE_2=-4.0782D^2+8.9461D+0.0085
Imli	Tamarindus indica	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1821	BE2=-1.0538D^2+4.4842D+0.0021
Teak	Tectona grandis	V/D=0.00341/D-0.65623+7.881D	BE_1=-218.7650D^2+252.6165D-6.4059	BE_2=-19.8692D^2+21.2077D-0.5973
		√V=-0.07109+2.99732D-0.26953√D	BE_1-218.7650D^2+252.6165D-6.4059	BE_2=-19.8692D^2+21.2077D-0.5973
		V=0.08847-1.46936D+11.98979D^{2}+1.970560D^{3}	BE_1=-235.2067D^2+454.1317D-29.7996	BE_2=-9.3264D^2+18.3483D-0.8165
		√V=-0.405890+1.98158D+0.987373√D	BE_1=-235.2067D^2+454.1317D-29.7997	BE_2=-9.3264D^2+18.3483D-0.8166
		√V=-0.106720+2.562418D	BE1=-172.2384D^2+234.5179D-5.5075	BE_2=-17.8148D^2+24.5465D-0.6082
		V/D^{2}=0.045181/D^{2}-0.91863/D+8.18261+1.95661D	BE1=-172.2384D^2+234.5179D-5.5075	BE_2-17.8148D^2+24.5465D-0.6082
		V=-0.2414+2.8458D-5.5816D^{2}+14.816D^{3}	BE_1=-235.2067D^2+454.1317D-29.7996	BE_2=-9.3264D^2+18.3483D-0.8165
		V/D^{2}=0.12591/D^{2}-2.45212/D+16.52336-7.57135D	BE1=621,9517D^2-154,0887D+25,0717	BE_2=9.0619D^2-1.0880D+0.5855

		V=0.023613-0.531006D+6.731036D^{2}	BE1=621,9517D^2-154,0887D+25,0718	BE_2=9.0619D^2-1.0880D+0.5856
Bahera	Terminalia bellirica	V=0.26454-3.05249D+12.35740D^{2}	BE_1=138.5098D^2+230.1472D-12.1090	BE_2=5.1039D^2+8.0168D-0.3351
		V=10.988D^{2.6676}	BE_1=138.5098D^2+230.1472D-12.1090	BE_2=5.1039D^2+8.0168D-0.3351
Harar	Terminalia chebula	V/D^{2} = 0.048532/D^{2} -1.05615/D + 8.204564	BE_1=138.5098D^2+230.1472D-12.1091	BE_2=5.1039D^2+8.0168D-0.3352
Sain	Terminalia elliptica	$\sqrt{V}$ = -0.203947 + 3.159215 D	BE_1=138.5098D^2+230.1472D-12.1092	BE_2=5.1039D^2+8.0168D-0.3353
Tun	Toona ciliata	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1859	BE2=-1.0538D^2+4.4842D+0.0059
Tung	Vernicia fordi	V=(0.131-1.87132D+9.47861D)	BE1=-46.9981D^2+148.5105D+1.1860	BE2=-1.0538D^2+4.4842D+0.0060
Ber	Ziziphus mauritiana	V=0.027354+4.663714D^{2}	BE1=700.8008D^2-165.1396D+18.5104	BE_2=9.8070D^2-1.2673D+0.2926

Table 3: Calculation of carbon mass of trees grown under MGNREGA

Note 1: Carbon sequestration is calculated for a single tree.
Cells highlighted in **Green** have region specific equations – Carbon sequestration is calculated for each region, and average of all values is considered in the tool)
Note 2: Cells Highlighted in **Yellow** doesn't have tree specific equations – Carbon sequestration is calculated using common equation.
Note 3: Specific gravity, diameter (m) of trees were analysed using literature. For the tree where data is not available, generic values are taken.
D: Diameter at breast height.

Tree name (local name)	Scientific Name	Specific gravity (1)	Diameter (m/tree) (2)	Volume (m^3/tree) (3)	Bole Biomass (BB)(MT) (4)=(1)*(3)	BE1 (Kg) (5)	BE2 (Kg) (6)	B (MT) (7)=(5+6)/1000	AGB (BB+B) (8)=(4)+(7)	AGB carbon (47% of biomass - IPCC) (9)=(8)*0.47	BGB carbon (20.8% of ABG – IPCC) (10)=(9)*0.21	Carbon Sequestered per tree (MT/tree) (AGB+BGB) (11)=((9)+(10)	Carbon di oxide sequestered (MT/tree) (12)=(11)*3.66
Aam	Mangifera indica-	0.60	0.70	2.62	1.57	195.68	8.43	0.20	1.77	0.83	0.17	1.01	3.69

Fir	Abies spp.-	0.45	0.10	0.11	0.05	19.29	2.29	0.02	0.07	0.03	0.01	0.04	0.15
Khair	Acacia catechu-	0.70	0.35	0.69	0.48	36.89	1.62	0.04	0.52	0.24	0.05	0.29	1.08
Khair	Acacia catechu-	0.70	0.35	0.80	0.56	53.27	3.82	0.06	0.62	0.29	0.06	0.35	1.29
Khair	Acacia catechu-	0.70	0.35	0.80	0.56	53.27	3.82	0.06	0.62	0.29	0.06	0.35	1.29
Khair	Acacia catechu-	0.70	0.35	0.67	0.47	67.19	2.54	0.07	0.54	0.25	0.05	0.31	1.13
Khair	Acacia catechu-	0.70	0.35	0.67	0.47	92.47	4.36	0.10	0.57	0.27	0.06	0.32	1.18
Khair	Acacia catechu-Average	0.70	0.35	0.73	0.51	60.62	3.23	0.06	0.57	0.27	0.06	0.33	1.19
Babul	Acacia nilotica-	0.70	0.35	0.44	0.31	35.64	2.73	0.04	0.35	0.16	0.03	0.20	0.73
Acacia	Acacia spp.-	0.75	0.40	0.58	0.43	38.76	3.06	0.04	0.47	0.22	0.05	0.27	0.99
Maple	Acer spp.-	0.55	0.60	2.95	1.62	73.37	2.31	0.08	1.70	0.80	0.17	0.96	3.53
Ailanthus	Ailanthus altissima-	0.53	0.40	0.82	0.43	91.76	4.04	0.10	0.53	0.25	0.05	0.30	1.10
Ailanthus	Ailanthus altissima-	0.53	0.40	0.69	0.36	91.76	4.04	0.10	0.46	0.22	0.05	0.26	0.96
Ailanthus	Ailanthus altissima-	0.53	0.40	2.14	1.14	91.76	4.04	0.10	1.23	0.58	0.12	0.70	2.56
Ailanthus	Ailanthus altissima-	0.53	0.40	2.14	1.14	91.76	4.04	0.10	1.23	0.58	0.12	0.70	2.56
Ailanthus	Ailanthus altissima-Average	0.53	0.40	1.45	0.77	91.76	4.04	0.10	0.86	0.41	0.08	0.49	1.80
Siris	Albizia lebbeck-	0.60	0.55	1.90	1.14	68.65	2.15	0.07	1.21	0.57	0.12	0.69	2.52
Utis	Alnus nepalensis-	0.50	0.50	2.94	1.47	265.42	5.68	0.27	1.74	0.82	0.17	0.99	3.63
Cashew	Anacardium occidentale-	0.65	0.60	1.81	1.17	158.36	6.75	0.17	1.34	0.63	0.13	0.76	2.79
Dhauri	Anogeissus latifolia-	0.65	0.50	1.86	1.21	111.50	5.85	0.12	1.33	0.62	0.13	0.75	2.76
Dhauri	Anogeissus latifolia-	0.65	0.50	1.93	1.25	111.50	5.85	0.12	1.37	0.64	0.13	0.78	2.85
Dhauri	Anogeissus latifolia-	0.65	0.50	1.98	1.29	111.50	5.85	0.12	1.41	0.66	0.14	0.80	2.93

Dhauri	Anogeissus latifolia-	0.65	0.50	1.91	1.24	111.50	5.85	0.12	1.36	0.64	0.13	0.77	2.82
Dhauri	Anogeissus latifolia-	0.65	0.50	2.54	1.65	52.37	5.31	0.06	1.71	0.80	0.17	0.97	3.56
Dhauri	Anogeissus latifolia-	0.65	0.50	2.03	1.32	52.37	5.31	0.06	1.38	0.65	0.13	0.78	2.87
Dhauri	Anogeissus latifolia-	0.65	0.50	1.91	1.24	142.31	3.86	0.15	1.38	0.65	0.14	0.79	2.88
Dhauri	Anogeissus latifolia-	0.65	0.50	1.91	1.24	142.31	3.86	0.15	1.38	0.65	0.14	0.79	2.88
Dhauri	Anogeissus latifolia-Average	0.65	0.50	2.01	1.30	104.42	5.22	0.11	1.41	0.66	0.14	0.80	2.94
Angu	Artocarpus hirsutus-	0.70	0.45	1.78	1.25	102.16	5.33	0.11	1.36	0.64	0.13	0.77	2.82
Neem	Azadirachta indica-	0.68	1.00	5.29	3.60	263.53	10.88	0.27	3.87	1.82	0.38	2.20	8.07
Bans	Bambusa bambos-	0.60	0.20	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Bamboo	Bambusa spp.-	0.60	0.20	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Kwiral	Bauhinia variegate-	0.70	0.45	0.80	0.56	59.70	2.20	0.06	0.62	0.29	0.06	0.35	1.29
Semul	Bombax ceiba-	0.33	0.75	6.50	2.15	103.70	3.21	0.11	2.25	1.06	0.22	1.28	4.69
Semul	Bombax ceiba-	0.33	0.75	4.29	1.42	103.70	3.21	0.11	1.52	0.72	0.15	0.86	3.17
Semul	Bombax ceiba-Average	0.33	0.75	5.40	1.78	103.70	3.21	0.11	1.89	0.89	0.18	1.07	3.93
Deodar	Cedrus deodara-	0.40	0.75	2.19	0.88	177.64	4.57	0.18	1.06	0.50	0.10	0.60	2.20
Kapok	Ceiba pentandra-	0.35	0.75	2.19	0.77	177.64	4.57	0.18	0.95	0.45	0.09	0.54	1.97
Ringal	Chimnobabusa falcata-	0.70	0.45	0.80	0.56	59.70	2.20	0.06	0.62	0.29	0.06	0.35	1.29
Tejpatand	Cinnamomum tamala-	0.70	0.45	0.80	0.56	59.70	2.20	0.06	0.62	0.29	0.06	0.35	1.29
Nimbu	Citrus limon-	0.70	0.30	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Malta	Citrus X sinensis-	0.70	0.30	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09

Surai	Cupressus torulosa-	0.55	0.60	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Shisham	Dalbergia sissoo-	0.80	0.65	2.69	2.15	49.95	7.57	0.06	2.21	1.04	0.22	1.25	4.60
Cheura	Diploknema butyracea-	0.70	0.60	2.63	1.84	70.71	15.88	0.09	1.93	0.91	0.19	1.10	4.02
Other	Equation for rest of species-	0.63	0.50	1.37	0.86	111.50	5.85	0.12	0.98	0.46	0.10	0.56	2.04
Other	Equation for rest of species-	0.63	0.50	1.16	0.73	111.50	5.85	0.12	0.85	0.40	0.08	0.48	1.77
Other	Equation for rest of species-	0.63	0.50	1.55	0.98	111.50	5.85	0.12	1.10	0.52	0.11	0.62	2.28
Other	Equation for rest of species-	0.63	0.50	1.55	0.98	111.50	5.85	0.12	1.10	0.52	0.11	0.62	2.28
Other	Equation for rest of species- Average	0.63	0.50	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Eucalyptus	Eucalyptus spp.-	0.75	0.65	3.13	2.35	77.89	17.84	0.10	2.45	1.15	0.24	1.39	5.09
Timla	Ficus auriculata-	0.50	0.65	3.71	1.85	171.66	19.99	0.19	2.05	0.96	0.20	1.16	4.26
Kokum	Garcinia indica-	0.90	0.45	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Bhimal	Gmelina arborea-	0.50	0.50	1.39	0.70	63.69	1.98	0.07	0.76	0.36	0.07	0.43	1.59
Phalyat	Grewia asiatica-	0.70	0.35	0.62	0.43	73.01	2.77	0.08	0.51	0.24	0.05	0.29	1.05
Kharsu	Grewia optiva-	0.70	0.45	1.29	0.90	111.77	4.52	0.12	1.02	0.48	0.10	0.58	2.12
Haldu	Haldina cordifolia-	0.70	0.60	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Jatropha	Jatropha curcas-	0.70	0.30	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Akhrot	Juglans regia-	0.60	0.77	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Subabul	Leucaena leucocephala-	0.50	0.20	0.01	0.01	11.46	0.33	0.01	0.02	0.01	0.00	0.01	0.04
Mahua	Madhuca longifolia-	0.74	0.50	0.73	0.54	111.50	5.85	0.12	0.66	0.31	0.06	0.37	1.37
Mahua	Madhuca longifolia-	0.60	0.50	1.56	0.93	111.50	5.85	0.12	1.05	0.49	0.10	0.60	2.19

Mahua	Madhuca longifolia-Average	0.60	0.50	1.15	0.74	111.50	5.85	0.12	0.86	0.40	0.08	0.49	1.78
Karanja	Millettia pinnata-	0.70	0.45	3.10	2.17	91.05	9.98	0.10	2.27	1.07	0.22	1.29	4.73
Bakil	Mimusops elengi-	0.70	0.55	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Shahtoot	Morus spp.-	0.55	0.60	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Kafal	Myrica esculenta-	0.70	0.45	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Olive	Olea europaea-	0.75	0.50	1.41	1.06	63.69	1.98	0.07	1.12	0.53	0.11	0.64	2.34
Kharik	Phoenix dactylifera-	0.75	0.45	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Anwala	Phyllanthus emblica-	0.45	0.40	0.76	0.34	91.76	4.04	0.10	0.44	0.21	0.04	0.25	0.91
Spruce	Picea spp.-	0.45	0.60	3.42	1.54	149.04	17.16	0.17	1.70	0.80	0.17	0.97	3.55
Chir	Pinus roxburghii-	0.50	0.80	5.40	2.70	343.66	18.98	0.36	3.06	1.44	0.30	1.74	6.37
Chamkharik	Pithecellobium dulce-	0.65	0.90	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Poplar	Populus spp.-	0.45	0.60	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Wild Aprikot	Prunus armeniaca-	0.65	0.30	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Amrood	Psidium guajava-	0.67	0.15	0.45	0.30	23.54	1.88	0.03	0.33	0.15	0.03	0.19	0.68
Mehal	Pyrus pashia-	0.70	0.30	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Moru	Quercus floribunda-	0.70	0.60	2.82	1.98	104.91	5.71	0.11	2.09	0.98	0.20	1.19	4.35
Banj	Quercus leucotrichophora-	0.70	0.75	2.87	2.01	139.28	7.18	0.15	2.16	1.01	0.21	1.22	4.49
Robinia	Robinia pseudoacacia-	0.70	0.50	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Salix	Salix alba-	0.45	0.35	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Sal	Shorea robusta-	0.70	0.90	7.28	5.09	211.84	21.55	0.23	5.33	2.50	0.52	3.03	11.09
Sal	Shorea robusta-	0.70	0.90	7.28	5.09	211.84	21.55	0.23	5.33	2.50	0.52	3.03	11.09

Sal	Shorea robusta-	0.70	0.90	5.35	3.75	211.84	21.55	0.23	3.98	1.87	0.39	2.26	8.28
Sal	Shorea robusta-	0.70	0.90	7.47	5.23	189.00	16.49	0.21	5.44	2.55	0.53	3.09	11.32
Sal	Shorea robusta-	0.70	0.90	7.99	5.59	163.07	18.08	0.18	5.77	2.71	0.56	3.28	12.02
Sal	Shorea robusta-	0.70	0.90	7.99	5.59	163.07	18.08	0.18	5.77	2.71	0.56	3.28	12.02
Sal	Shorea robusta-Average			7.23	5.06	191.78	19.55	0.21	5.27	2.48	0.52	2.99	10.97
Simarouba	Simarouba glauca-	0.45	0.45	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Jajoba	Simmondsia chinensis-	0.70	0.30	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Jamun	Syzygium cumini-	0.70	0.45	0.98	0.69	107.41	4.64	0.11	0.80	0.38	0.08	0.45	1.67
Jamun	Syzygium cumini-	0.70	0.45	1.21	0.85	107.41	4.64	0.11	0.96	0.45	0.09	0.55	2.00
Jamun	Syzygium cumini-	0.70	0.45	1.38	0.96	147.04	3.21	0.15	1.11	0.52	0.11	0.63	2.32
Jamun	Syzygium cumini-	0.70	0.45	1.46	1.02	147.04	3.21	0.15	1.17	0.55	0.11	0.66	2.43
Jamun	Syzygium cumini-Average	0.70	0.45	1.26	0.88	127.22	3.92	0.13	1.01	0.48	0.10	0.57	2.11
Imli	Tamarindus indica-	0.60	1.00	7.74	4.64	102.69	3.43	0.11	4.75	2.23	0.46	2.70	9.89
Teak	Tectona grandis-	0.60	1.00	7.23	4.34	27.45	0.74	0.03	4.37	2.05	0.43	2.48	9.09
Teak	Tectona grandis-	0.60	1.00	2.85	1.71	27.45	0.74	0.03	1.74	0.82	0.17	0.99	3.62
Teak	Tectona grandis-	0.60	1.00	12.58	7.55	189.13	8.21	0.20	7.75	3.64	0.76	4.40	16.12
Teak	Tectona grandis-	0.60	1.00	6.57	3.94	189.13	8.21	0.20	4.14	1.95	0.40	2.35	8.62
Teak	Tectona grandis-	0.60	1.00	6.03	3.62	56.77	6.12	0.06	3.68	1.73	0.36	2.09	7.66
Teak	Tectona grandis-	0.60	1.00	9.27	5.56	56.77	6.12	0.06	5.62	2.64	0.55	3.19	11.70
Teak	Tectona grandis-	0.60	1.00	11.84	7.10	189.13	8.21	0.20	7.30	3.43	0.71	4.14	15.20
Teak	Tectona grandis-	0.60	1.00	6.63	3.98	492.93	8.56	0.50	4.48	2.10	0.44	2.54	9.32
Teak	Tectona grandis-	0.60	1.00	6.22	3.73	492.93	8.56	0.50	4.24	1.99	0.41	2.40	8.82
Teak	Tectona grandis-Average	0.60	1.00	7.69	4.61	191.30	6.16	0.20	4.81	2.26	0.47	2.73	10.02

Bahera	Terminalia bellirica-	0.70	0.70	4.18	2.93	216.86	7.78	0.22	3.15	1.48	0.31	1.79	6.56
Bahera	Terminalia bellirica-	0.70	0.70	4.24	2.97	216.86	7.78	0.22	3.19	1.50	0.31	1.81	6.65
Bahera	Terminalia bellirica-Average	0.70	0.70	4.21	2.95	216.86	7.78	0.22	3.17	1.49	0.31	1.80	6.61
Harar	Terminalia chebula-	0.70	0.60	2.81	1.97	175.84	6.31	0.18	2.15	1.01	0.21	1.22	4.48
Sain	Terminalia elliptica-	0.70	0.60	2.81	1.97	175.84	6.31	0.18	2.15	1.01	0.21	1.22	4.48
Tun	Toona ciliata-	0.55	0.75	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Tung	Vernicia fordi-	0.80	0.45	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09
Ber	Ziziphus mauritiana-	0.70	0.45	1.41	0.89	111.50	5.85	0.12	1.01	0.47	0.10	0.57	2.09