Permaculture Design
Certification Course

Institute of Integrated Regenerative Design

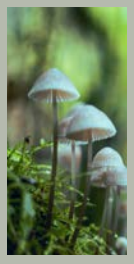
Join us for this 2-week intensive journey into permaculture design presented through a curriculum specifically created for professional designers. The course meets all requirements for the internationally recognized 72-hour PDC certification.

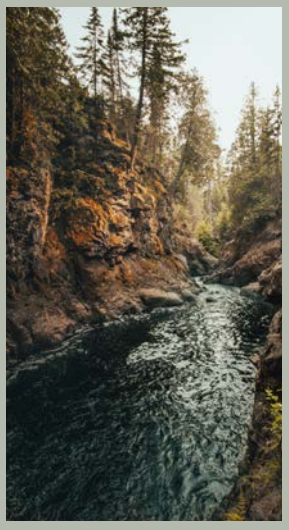
The internationally-recognized Permaculture Design Certification (PDC) course has been taught around the world for almost four decades. Given permaculture's early emphasis on agriculture, most of these courses have been oriented primarily towards an audience interested in homestead and farm design.

But as permaculture has been applied to an increasingly wide array of problems, the demand for PDC's tailored to other audiences has also exploded.

One of the key emerging challenges is how to apply permaculture's regenerative design tools in professional design contexts. To meet this need, Wheaton Labs has teamed up with Alan Booker from the Institute of Integrated Regenerative Design to present a PDC specifically targeted for design professionals such as engineers, architects, urban planners, landscape architects, and those interested in pursuing permaculture design at larger scales.

The 2023 Wheaton Labs PDC is structured to meet all of the requirements for the 72-hour Permaculture Design Certification while also being aimed at a professional audience.





The course is presented at a graduate school level, meaning that students are expected to already have undergraduate-level knowledge of physics, chemistry, and biology.

Many of the permaculture concepts have been updated and expanded using the latest in peer-reviewed science and professional practice.

Since this is a design course, students will be assigned to small design teams and start working on design exercises on the first day. During the second week, students will transition over to working on their final design projects individually. The capstone of the course involves each student individually presenting their design project to the class.

The PDC consists of 48 main sessions of 90-minute each, along with daily design sessions, hands-on experiences, group exercises, and a final design project prepared and presented indivually. Students must complete all assignments in order to achieve certification.

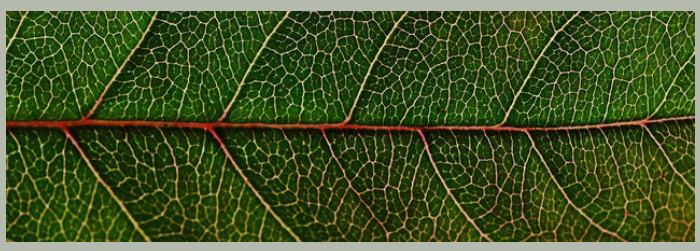
Day One

M01 – Introduction and Overview
- Welcome and introductions
- Overview of course and course requirements
- Definition of Permaculture
- Basic History and Goals of Permaculture
- Permaculture as Design Science
- High Tech vs. Low Tech

M02 – Ethics in Design
- The Rules of Three and the Purpose of Design
- The Permaculture Prime Directive
- The Principle of Cooperation
- The Three Ethics
- The Fractal Nature of the Three Ethics
- Applying Ethics to Design
- The Precautionary Principle
- Designing for Positive Outcomes

M03 – Design Concepts 1
- The Earth-Space Battery
- Basic Thermodynamics
- Systems & Boundaries
- Mechanistic vs. Complex vs. Ecological Systems
- The Burden Shifts to the Intervener
- Mollisonian Design Principles
- Resources & Yields
- Birch's Six Principles of Natural Systems
- Be Careful What You Incentivize

M04 – Design Concepts 2
- Holmgren's Permaculture Flower
- Holmgren's 12 Design Principles
- Yeoman's Scale of Permanence
- Diversity, Stability, Resilience, & Interconnection of Elements
- "It Depends"



Day Two

M05 – Methods of Design Part 1
- Definition of Design
- Definition of Permaculture Design
- Stacking Functions (Prime Directive of Function)
- Principle of Self-Regulation
- Bottom-up vs. Top-down Design
- Fabrication vs. Generation
- Wholeness-Extending Transformations
- Observation in Design
- Element Analysis: Properties and Behaviors
- Sun Movement throughout the Day & Seasons

M06 – Methods of Design Part 2
- Defining Zones and Sectors
- Sectors, Flows, and Gradients
- SFG Maps
- Zones
- Applying Zones and Sectors and Varying Scales

M07 – Methods of Design Part 3
- Ecological Succession
- Annuals, Biennials, and Perennials
- R-Selected vs K-Selected Species
- The Successional Mosaic
- Bacterial and Fungal Balance through Succession
- Ecotones and Edge Effect
- Successional Edges

M08 – Methods of Design Part 4
- Definition of Polyculture, Guilds, and Companion Planting
- Tree Guilds
- Creating Microclimates
- Base Maps & Flow Diagrams
- Articulation from Observed Pattern
- Random Assembly
- Incremental Design
- Design for Catastrophe
- Wheaton's Law of Human Factors
- Risk Management
- Troubleshooting and Root-Cause Analysis
- A Caution on Powerful Tools

Day Three

M09 – Pattern Understanding Part 1
- Introduction to Patterns and Complexity
- The Biophilia Hypothesis
- General Model of a System
- Definition of Pattern
- The General Pattern Model of Events
- Chaos, Complexity, and Strange Attractors
- Pattern Languages
- Defining Anti-pattern
- A Taxonomy of Patterns
- A Pattern Definition of Sustainable and Regenerative

M10 – Pattern Understanding Part 2
- The Fractal Structure of Nature
- Defining Fractals
- Fractal Dimension
- Emergent Properties
- Orders of Scale & Relative Abundance
- Properties of Media
- Surface Area and Interactions at the Edges
- Boundary Conditions and Harmonics
- Tessellations and Tiling
- Voronoi Tessellations

M11 – Pattern Understanding Part 3
- Compatible and Incompatible Borders and Components
- Radials
- Branching & Spirals
- Meshes & Nets
- Graphs
- Small World Networks
- The Network Effect
- Flow over Landscapes & Objects
- Accretion and Expulsion
- The Time-Sequencing of Patterns

M12 – Pattern Understanding Part 4
- Patterns in Human Thought: Schema vs. Procedural Thinking
- Examples of Tribal Uses of Patterns
- Patterning to Encode and Transmit Information
- Patterns in Human Society & Settlements
- Human Scale & Dunbar's Number
- The W.E.I.R.D. Problem

Day Four

M13 – Climate Factors 1
- Introduction to Climate
- Classification of Climate Zones
- Climate Analogues
- Biomass Above/Below Ground in Various Climate Zones
- USDA Hardiness Zones
- Heat Zones
- Climate's Effects on Terrestrial Biomass
- What to Consider When Designing for a Specific Region
- Evaporation vs. Precipitation
- Savory Brittleness Scale
- Effective Rain, Condensation & Dew
- Orographic Effects, Physical Geography, and Bodies of Water
- Urban Heat Island Effect
- Climate Change

M14 – Climate Factors 2
- Climate and Topography
- Solar Radiation
- Heat Transfer – Conduction, Convection, and Radiation
- Density vs. Temperature
- Albedo & Absorption
- Solar Reflectance Index (SRI)
- Frost
- Seasonal Winds and Prevailing Winds
- Wind, Windbreaks, and Shelter Belts
- Continental vs. Maritime Climates
- Valley Climates
- Latitude and Altitude

M15 – Trees & Their Energy Transactions 1

- The Place of Trees in Ecosystems
- The Biomass of Trees
- Pollination and Genetic Variability in Productive Trees
- Growing Trees from Seed vs. Transplanting
- Rootstock
- Planting and Transplanting Trees
- Protecting the Root Zone
- Non-photochemical Quenching
- Wind Effects on Trees

M16 – Trees & Their Energy Transactions 2

- The Time Scale of Trees
- The Ecological Importance of Fire
- Prescribed Burning
- Wood Vinegar
- Trees and Precipitation
- Evapotranspiration
- Rain Nucleation by Trees
- The Tree's Interaction with Rain
- The Dynamics of Rain Landing on Bare Soil
- Trees and Grasses

Day Five

M17 – Water Part 1

- Introduction to Water
- The Unique Properties of Water
- The Four Phases of Water
- The Duties of Water
- The Large and Small Hydrological Cycles
- Acid Rain
- Watersheds
- Flood Plains
- The Ecological Effects of Dams
- Water Flow through Soils and Rock
- Aquifers
- Springs and Springlines
- Drinking Water Sources
- Water Storages
- Water Conservation
- Trompes
- Ram Pumps

M18 – Water Part 2

- Roof Catchment of Rain Water & Storage Tanks
- Definition of Swales and Diversion Drains
- The Problems of Irrigation & Aquifer Pumping
- Water for Irrigation
- Irrigation Methods
- Purification of Polluted Waters & Reduction of Waste Water
- Natural Swimming Pools
- Flow Forms & Aeration

Day Six

M19 – Soils Part 1: Physical Characteristics

- The Importance of Soil
- Soil Composition: Inorganic, Organic, Gas, and Soil Life
- Soil Horizons
- Soil Types
- The Inorganic Constituents of Soil
- Flocculation of Clay Soils
- Measuring Soil Composition with the Jar Test
- Estimating Soil Composition by Hand Feel
- Soil Tilth, Pore and Crumb Structure
- Atterberg Limits & the 4 Phases of Soil Dynamics
- Very Dry and Non-wetting Soils
- Gaseous Content and Processes in the Soil
- Soil Compaction, Causes of Compaction, Measuring Compaction
- Angle of Repose
- Soils in Building Foundations

M20 – Soils Part 2: Soil Chemistry

- Important Elements for Life in Soil and Water
- Soil Elements Critical for Plant Life
- Macronutrients &Micronutrients
- How Plants Uptake Nutrients
- Cation Exchange Capacity (CEC)
- pH and Soils
- The Biological Dimension of pH
- Soil Testing
- Methods to Re-mineralize Soils
- The Structural and Biological Effects of Plowing

M21 – Soils Part 3: Soil Biology

- Strategy for Healthy Plants and Animals
- The Soil-Food Web & Soil Biota
- Soil Life: Good Guys vs. Bad Guys
- Korean Natural Farming
- Difficult Soils
- Soil Erosion & Preventing Erosion
- Soil Remediation

M22 – Compost & Aerated Compost Tea

- Types of Compost
- Thermophilic Compost
- Aerated Static Pile Compost
- Anaerobic Composting
- Bokashi
- Applying Compost
- Making Thermophilic Compost
- Sheet Mulching
- Vermicomposting
- Aerated Compost Teas
- Biochar
- Using Black Soldier Fly Larvae

M23 – Annual Crop Gardening

- Introduction to Annual Crop Gardens
- Biological vs. Chemical Cultivation of Crops
- Brix & Brix Measurement
- The Kitchen Garden and the Production Garden
- Common Vegetable Families
- Bio-intensive Gardening
- Shade Cloth and Hardening Off Plants
- The Double-digging Method

M24 – Seeds & Seed Saving

- The Critical Importance of Seed
- Propagation by Seed vs. Propagation by Cuttings
- Heirloom Seeds & Open Pollinated Seeds
- Cross-pollination
- Choosing Seed to Save
- Saving & Storing Seed
- Germination Rates and Germination Testing
- The Importance of Careful Genetic Selection
- Breeding Locally Adapted Varieties
- Local Seed Sharing & Seed Libraries
- Seed Balls (Seed Pelleting)

Day Seven

M25 – Earthworks Part 1
- Introduction to Earthworks
- The Energy Audit of Earthworks
- Planning Earthworks
- Types of Earthworks & Earth Constructs
- Types of Earthwork Equipment
- Restoring Topsoil & Planting after Earthworks

M26 – Earthworks Part 2
- Calculating Slope
- Contour & Contour Lines
- A-frame Levels, Water Levels, Transit Levels, and Laser Levels
- Marking Sites using Flags and Paint
- Working with Equipment Operators
- Terms to Include in Contracts
- Erosion Control Strategies

M27 – Earthworks Part 3
- Designing Swales & Diversion Drains
- Berms and Basins
- Level-Sill Spillways & Designing Overflows
- Pond Types and Locations
- Designing Ponds & Dams
- Keyway Construction for Dam Walls
- Sealing Ponds & Dams
- Methods of Tapping and Draining Ponds
- The 3-D Topology of the Soil Strata
- Hyporheic Zones in Stream Beds

M28 – Earthworks Part 4
- Overview of Keyline Design
- Definition of Key Point and Key Line
- The Keyline Plough
- Patterns of Keyline Ploughing
- Siting Roads

Day Eight

M29 – Humid Tropics Part 1
- Introduction to Major Climate Zones for Design
- Wet Tropics, Wet-Dry Tropics, & Monsoon Tropics
- Soils in Tropical Climates
- Earth Shaping for the Tropics
- Building Design Strategies for Tropical Climates
- Gardening in the Tropics

M30 – Humid Tropics Part 2
- Integrated Land Management and the Ohana System of Hawaii
- Village Organization in the Tropics
- Developing Polycultures in Tropical Systems
- Coconut and Palm Polycultures
- Rehabilitation of Degraded Tropical Systems via Pioneering

M31 – Dryland Strategies Part 1
- Definition and Characteristics of Drylands
- Precipitation & Temperature Variation in Arid Environments
- Dryland Soils
- Features of Desert Landscapes
- Harvesting & Storing Water in Arid Lands

M32 – Dryland Strategies Part 2
- Broad Strategies for Desert Settlements
- Houses for Desert Conditions
- Desert Gardens
- Establishing Trees in Deserts

Day Nine

M33 – Temperate Climates Part 1
- Introduction to Humid Cool & Cold Climates
- Characteristics of Temperate Climates
- Soils in Temperate Climate Areas
- The General Landscape Profile of a Temperate Climate Site
- Attributes of Settlements & Buildings for Temperate Climates

M34 – Temperate Climates Part 2
- The Lawn
- Gardens for Temperate Climates
- The Hunger Gap
- Timber Production Forests
- Hedge Rows
- Coppicing & Pollarding
- Strategies for Colder Climates
- Hugelkultur Beds
- Krater Gardens
- Dealing with Wildfire Risks

M35 – Pasture Systems
- The Problem of Continuous Grazing Systems
- Rotational Grazing & the Holistic Management System
- Simulating Predator/Grazer Interaction
- Using Chickens and Dung Beetles to Help Manage Fertility
- Managing Perennial Polyculture Pastures
- Electric Fencing & Cell Size
- Over-wintering Livestock
- Savanna Landscapes, Silvopasture & Alley-cropping
- Providing Water for Livestock
- Mineral Supplements
- Livestock Protection Animals

M36 – Food Forests & Perennial Systems
- Introduction to Food Forests
- Using Swales in Food Forests
- Food Forest Layers in Tropical & Temperate Climates
- Establishing Food Forests – Creating Perennial Polycultures
- The Time-Sequencing of a Food Forest – Accelerating Succession
- Animal Systems in Food Forests
- Using Chickens, Goats, and Pigs to Prepare the Ground
- Selecting Species & Cultivars

Day Ten

M37 – Working with Energy Flows
- Definition of Energy
- Embodied Energy and Emergy
- Energy Returned on Energy Invested (EROEI)
- Sustainable Energy Systems – Biogas, Solar, Wind, Hydro-power
- Energy Conservation
- Energy Use Intensity (EUI) for Buildings
- Managing Heat Flows
- Designing for Passive Solar Gain
- Calculating Sun Angle
- The Energy and Environmental Audit of Burning Wood
- Rocket Mass Stoves and Masonry Fireplaces for Heating
- High-value Uses of Electricity
- The Energy Audit of Tools

M38 – Natural Building Methods
- Introduction to Natural and Non-toxic Buildings
- Insulation vs Thermal Mass
- Building with Cob
- Straw bale Buildings – In-Fill and Load-Bearing Systems
- Earth Bags
- Natural Plasters & Natural Paints
- Natural Flooring Systems
- Roof Types – Thatch Roofs, Metal Roofs, Tiled Roofs, Living Roofs
- Greenhouses & Thermal Batteries
- The Walipini

M39 – The Permaculture Kitchen
- Introduction to the Permaculture Kitchen
- The Garden Sink
- Cooking with the Sun – Solar Stoves & Solar Ovens
- Cooking with Wood & Methane
- Cob Ovens
- Barrel Ovens & Rocket Ovens
- Rocket Stoves
- Cooking with Retained Heat
- The Zeer and Other Evaporative Coolers
- The Fermentation Station
- Outdoor Kitchens
- Cast Iron and Food-Safe Surfaces
- About Microwave Ovens and Unique Radiolytic Products (URPs)

M40 – Sanitation & Health
- Maintaining Optimal Human Health
- Sanitation in the Kitchen
- The 4-Bucket System for Sanitizing Dishes
- Composting Toilets
- Waste Disposal & Waste Elimination
- Types of Medical Care & the Medicine Pyramid
- Hunting & Wildcrafting

Day Eleven

M41 – Aquaculture
- Introduction to Aquaculture
- Aquaculture Approaches for Different Climate Zones
- Industrial vs Ecological Aquaculture Systems
- Lake and Pond Zones
- Aerobic vs Anaerobic Conditions in Aquatic Systems
- The Nitrogen Cycle in Aquatic Ecosystems
- Thermoclines and Turn-over: Holomictic and Meromictic Lakes
- Trophic Layers of Aquatic Ecosystems
- Species for Aquaculture Systems
- Configuration of Fish Ponds
- Growing Food for Aquaculture Systems
- Canals & Chinampas
- Aquaponic Systems

M42 – Animal Systems Part 1
- Introduction to Animal Systems
- Gestation Periods for Common Farm Animals
- Dairy Animals – Using Cows, Sheep, and Goats for Dairy
- Using Goats and Sheep for Meat and Fiber
- Pigs: Paddock-shift Systems, Forest Grazing, & Pigs as Cultivators
- Rabbits
- Ducks, Geese, & Turkeys

M43 – Animal Systems Part 2
- Using Animals for Land Clearing & Tilling
- Chickens in the Annual Production Garden
- Chicken Tractors, Egg-Mobiles & Feather-net
- Chickens Paddock Shift Systems in Food Forest, Soil Preparation
- Pollinators – Honey Bees, Mason Bees, & Native Pollinators
- Pigeons and Bats
- Guinea Fowl
- Restoring Trophic Layers & Working with Predators

M44 – Food Storage & Seasonal Eating
- Introduction to Food Storage
- Lacto-Fermentation
- Drying & Smoking
- Bulk Grain Storage
- Dairy Ferments
- Root Cellars
- Growing Season Extension Techniques

Day Twelve

M45 – Designing Invisible Structures
- Types of Invisible Structures
- Shared Stories & Social Cohesion
- Narratives as Drivers of World View
- Patterns of Change and the S-Curve of Adoption
- Local Production & Exchange as a Center of Mass for Community

M46 – Legal Structures
- Trusts and Corporations (LLC's)
- Managing Liability
- Land Access Strategies (co-housing, co-farming, intentional community, urban community block)
- Land Lease and Intergenerational Farming

M47 – Economics & Money Systems
- An Ecologically-Based Economic Model
- Forms of Capital
- Procreative, Generative, and Degenerative Assets
- Triple Bottom Line Accounting
- Formal and Informal Complementary Currencies
- Household and Community Economies
- Community Lending and Banking
- Entrepreneurship
- Right Livelihood

M48 – Village Development & Human Scale
- Defining Human Scale
- Community Governance at Human Scale
- Mentoring and Apprenticeship
- Intergenerational Connections
- Creating and Maintaining Social Fabric
- The Local & Global Permaculture Community

Day Thirteen

Design Presentations
- Morning Design Workshop
- Afternoon Design Presentations
- Celebration Dinner & Talent Show

The final design project unfolds as a series of small group design exercises followed by individual design work to finish the design concept. A series of 16 design modules guides students through the process over the 2-week course.

Design Project Sessions

D01 – Design Project Overview

D02 - Property Tour

D03 - How to Conduct a Client Interview

D04 - The Client Interview

D05 - Softward Design Tools

D06 - Gathering Climate & Landform Data

D07 - Building a Base Map

D08 - SFG Maps and Zonal Analysis

D09 – Designing Water & Access

D10 - Mainframe Forestry & Siting Buildings

D11 - Zones & Permanent Fencing

D12 - The In-Fill Mosaic

D13 - Aquaculture

D14 - Preparing the Presentation

D15 - Design Project Workshop

D16 - Presentation of the Design Projects

Curriculum Developer & Lead Instructor:

Alan Booker
LEED AP BD+C, WELL AP, LFA, GRP

Alan is the founder and executive director of the Institute of Integrated Regenerative Design, the creator of the Integrated Regenerative Design Framework, and the lead author of the Biocompatible Design Standards. He has over three decades of experience in systems engineering and sustainable design, consulting on large-scale regenerative design projects world-wide.

For more information about this course or about the IRD Framework, visit i2rd.co.

Institute of Integrated Regenerative Design